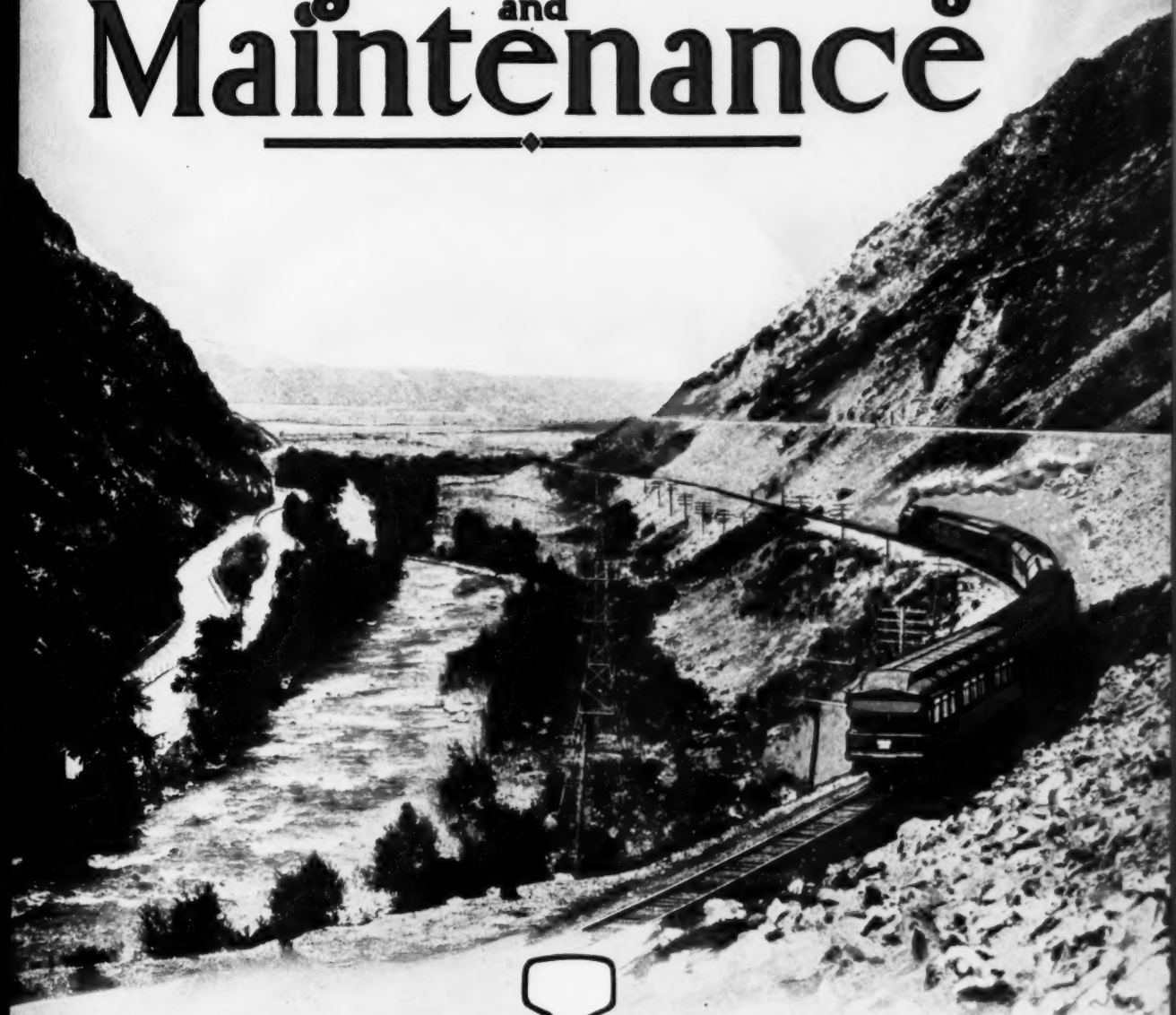
June, 1932

Railway Engineering and Maintenance



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RAILWAY ENGINEERING AND MAINTENANCE
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Alphabetical Index to Advertisers Page 422

6 CROSS TIE BULLETIN *January, 1932*

Roads Saved $33,000,000 on Cross Ties in 1929

Further Saving of $22,000,000 in Annual Renewals Held Possible

ACCUMULATED benefits from the practice of protecting cross ties from decay and wear were responsible for saving at least $33,000,000 for the Class I railways in 1929, states the Railway Age, in one of a series of articles on operating economies of the Interstate Commerce Commission, these railways renewed 74,679,375 cross ties at a total outlay of $100,585,843. Seventy nine per cent of these ties, or 59,047,380, were replaced by treated ties that cost $1.46 in track, while the remainder (except for a few steel and concrete ties) were of untreated wood that cost $0.93 in place. The renewals in 1929 represented an average replacement of 209 ties per mile of track (excluding the mileage laid with switch and bridge ties) out of a total of 2,974 ties per mile, which is equivalent to an average life of 14.2 years. If the railways had previously made all their renewals with untreated ties giving an average life of 7½ years, thereby requiring the annual renewal of 400 ties per mile, they would have been compelled to replace about 143,000,000 ties in 1929, which at a cost of $0.93 in place, would have required an outlay of $133,000,000

This accomplishment is by no means all that the railways can expect as the result of proper preservation and adequate protection of their ties. The attainment of a life of 14.2 years is only a fair performance compared with the results obtained on individual railways, some of which are renewing less than 100 ties per mile per year. If, therefore, the Class I railways should obtain an average life of 20 years from their cross ties, and this is by no means an unreasonable assumption, for it is already being exceeded by several roads, their annual requirements would amount to about 150 ties per mile, and they would then need to replace only 53,500,000 ties (on the basis of the present Class I mileage), which, at a cost of $1.46 per tie, would represent an outlay of $78,100,000. Thus, it is not at all unreasonable to assume that they can effect a still further saving of at least $22,000,000 in their annual tie renewals.

Whether this saving or an even larger sum is to be realized will depend on the extent to which the roads as a whole adopt, and rigidly adhere to, the practices observed by those roads which are now obtaining the longest life from their cross ties. There is no short cut to good results. Rather, the answer is to be found in scrupulous attention to details—a purchasing policy that embraces a rigid adherence to specifications as to both size and freedom from decay, collection and yard-age practices that will insure against decay after delivery, treatment that is adequate and adapted to the climatic conditions of service, effective protection of the ties from mechanical deterioration and supervision of the track forces that will insure against abuse and premature removal. These measures seem almost too obvious to deserve mention, but there is ample evidence that deviation for "practical" or "business" reasons has not infrequently resulted in a loss of useful tie life which far outweighed the temporary

There is opportunity also to improve the protection afforded the ties against mechanical deterioration. Larger tie plates of better design, with faster

plate relative to the tie are among the developments of recent years that will make for longer service life of cross ties. The railways that have made the longest use of these more advanced forms of construction are among those that now enjoy the lowest tie renewal records.

Specify LUNDIE *for* BETTER DESIGN

There is opportunity also to improve the protection afforded the ties against mechanical deterioration. Larger tie plates of better design . . . will make for longer service life of cross ties.

THE Lundie Tie Plate has that better design—therefore insures the utmost in tie conservation—maximum tie life—minimum tie renewals.

This scientifically designed plate has a canted bottom with well-rounded parallel undulations which hold track to rigid gauge. The Lundie is the ONE plate, which under heaviest loads, merely compresses the fibres of the ties—NEVER CUTS THEM. The Lundie never splinters the timber or cuts deep pockets which hold water, start and accelerate decay. Therein lies the supremacy of the Lundie design.

The economical distribution of the metal in the Lundie Plate insures maximum strength at minimum cost.

Specifying Lundie Plates now will insure immediate as well as continued economies.

The Lundie Engineering Corporation

285 Madison Avenue, New York
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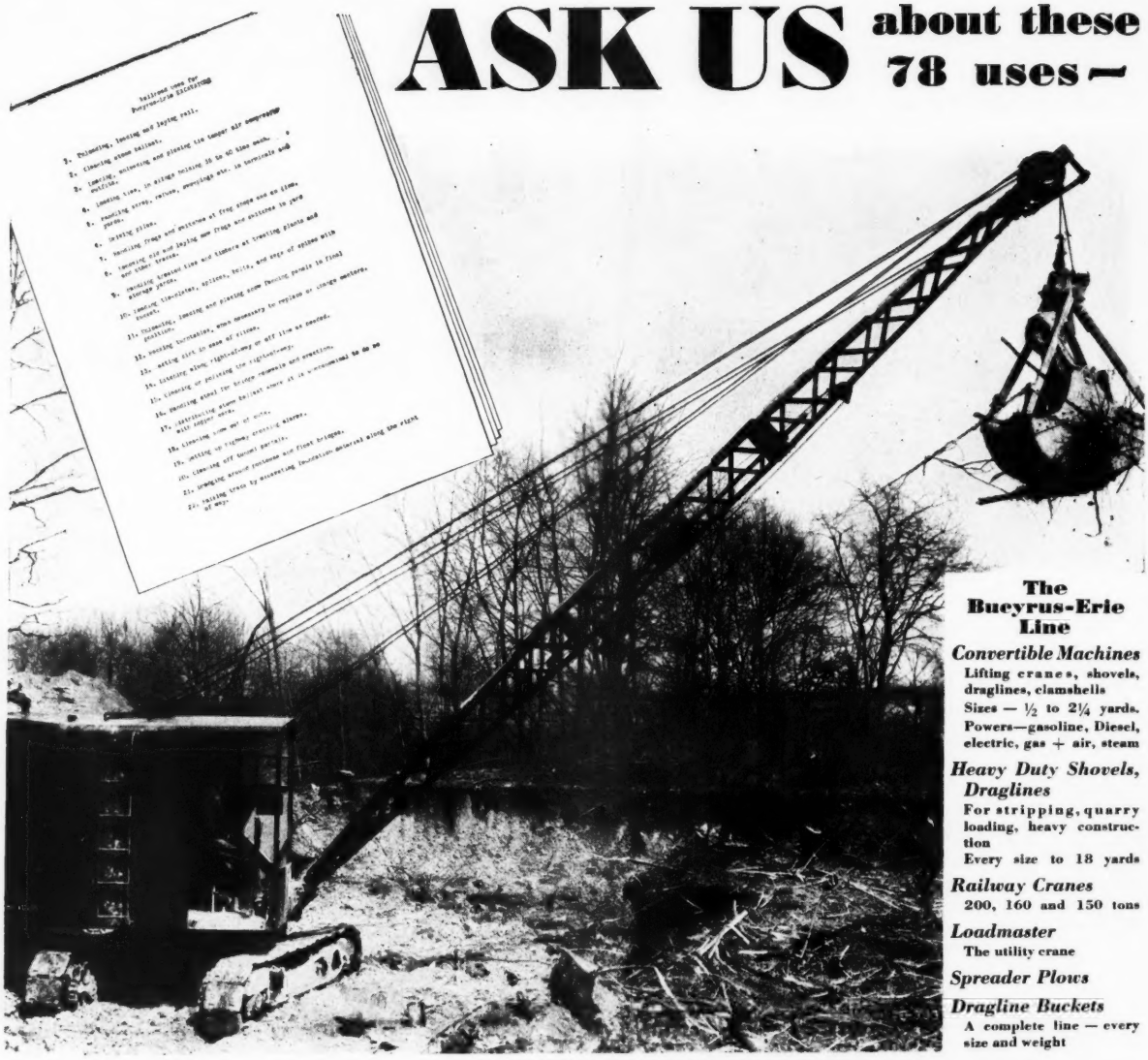
150,000,000 IN SERVICE PROVE THE ECONOMY OF THE LUNDIE PLATE

LUNDIE TIE PLATE

ASK US about these 78 uses—



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Convertible Machines
Lifting cranes, shovels, draglines, clamshells
Sizes — ½ to 2¼ yards.
Powers—gasoline, Diesel, electric, gas + air, steam

Heavy Duty Shovels, Draglines
For stripping, quarry loading, heavy construction
Every size to 18 yards

Railway Cranes
200, 160 and 150 tons

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The utility crane

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Dragline Buckets
A complete line — every size and weight

then plan your maintenance

around a many-purpose Bucyrus-Erie

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Moves along the track or along the cars in the train to handle your rail, scrap, ties, ballast.

Converts quickly from shovel to dragline, lifting crane or clamshell. A magnet crane or ditcher if your prefer.

Saves you days of work train expense, saves you buying additional equipment units you'd need with less flexible performance.

Brings you the economies of *modern* design resulting from close cooperation with railroadmen. Bucyrus-Erie Company, South Milwaukee, Wisconsin.

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for every railroad need

... a New Grinder to add New Life To Aging Rails

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Such a piece of equipment is the NORDBERG RAIL GRINDER, a new machine added to the fast growing line of Nordberg Machinery developed especially for track maintenance. This is a combination tool—for surface grinding joints after building up—for beveling or slotting rail ends to prevent chipping from the flow—and for grinding switches.

With the Nordberg, one man can grind 80 to 120 welds a day and with portable attachment slot 60 to 80 joints an hour or 10 to 18 switches per day. At switches, both switch points can be reached from one position.

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The NORDBERG RAIL GRINDER is the lightest machine of its kind—its controls are simple—the machine is easily handled—and the cross-grinder attachment permits it being used for jobs other than surface grinding after building up.

If you are doing any railwelding, it will pay you to ask for further information about NORDBERG Grinders and other Nordberg Track Maintenance Machinery.

NORDBERG

Railway Equipment Department
NORDBERG MFG. CO., Milwaukee, Wis.

No. 42 of a Series

Railway
Engineering and Maintenance
SIMMONS-BOARDMAN PUBLISHING COMPANY
105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: Two Attitudes

May 26, 1932

Dear Reader:

Sometime ago I received letters from the engineering executive officers of two prominent railways, in reply to a suggestion that these roads co-operate with us in increasing the circulation of Railway Engineering and Maintenance among their roadmasters and foremen.

One of these men replied that he could not approve of the suggestion because his men were not interested in reading, caring only for their pay checks. He then added that it was the policy of his road to confine the reading of its maintenance employees, so far as possible, to literature that the management prepared and distributed among them.

The other road welcomes the suggestion, stating that it encouraged its men to read literature relative to their work. "You may be interested in knowing," the letter continued, "that when we conducted a general examination of all of our employees on the book of rules a short time ago, we found that our maintenance of way employees stood at the head of the list. We found also, somewhat to our surprise, that these men were better informed as to the reasons for the rules than the men of any other department. This we attribute to the very general circulation of your paper among our men".

It is evident that on the latter road the interest of the men extended beyond their pay checks. I cannot help but believe that this attitude was due in no small measure to the interest shown by the management in its men. Comparing the two roads, I would rather be responsible for the work done by the men of the latter road. I wonder if you feel the same way.

Yours truly,

Elmer T. Howson
Editor.

ETH:EW

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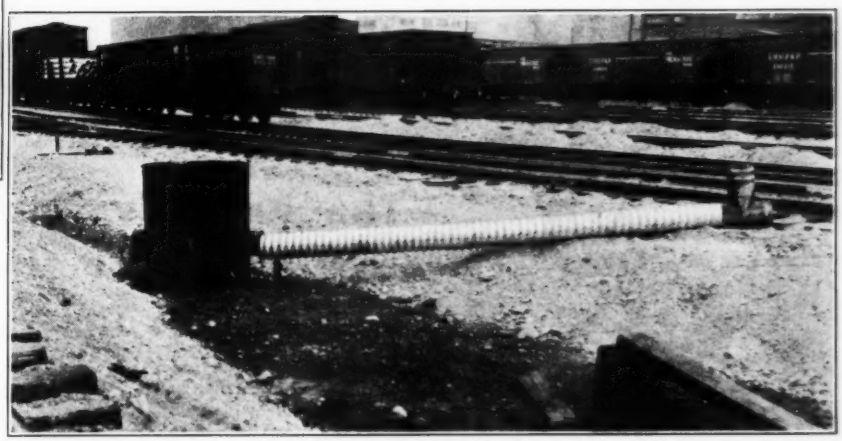
for Connections and Special Fittings for Railroad Drainage Systems

Typical arrangement of surface inlet. 8"x8"x6" tee with 8" drain riser and cast iron grate.



Typical Armco catch basin and inlet for lateral drains in service in one of the yards of a Western trunk line.

RAILROADS can simplify and speed up installations of culverts and subdrains by the use of sturdy, dependable Armco fittings and connections. Armco—headquarters for durable drainage pipe—is also headquarters for fittings, corrugated or plain, for complete drainage systems. Where special fittings and constructions are required, Armco can build them to order.

The same care in design and fabrication—the same strength and durability—the same simplicity and adaptability, which have won for Armco corrugated pipe recognition among railroads as a drainage product of highest quality, are in evidence in all standard Armco fittings and connections. The material used is Armco Ingot Iron—Nature-tested 26 years to date.

Armco fittings have been designed to meet all problems encountered in the railroad field. They include:

Elbows — Wyes
Bends — Crosses
Tees — Increasers and Reducers
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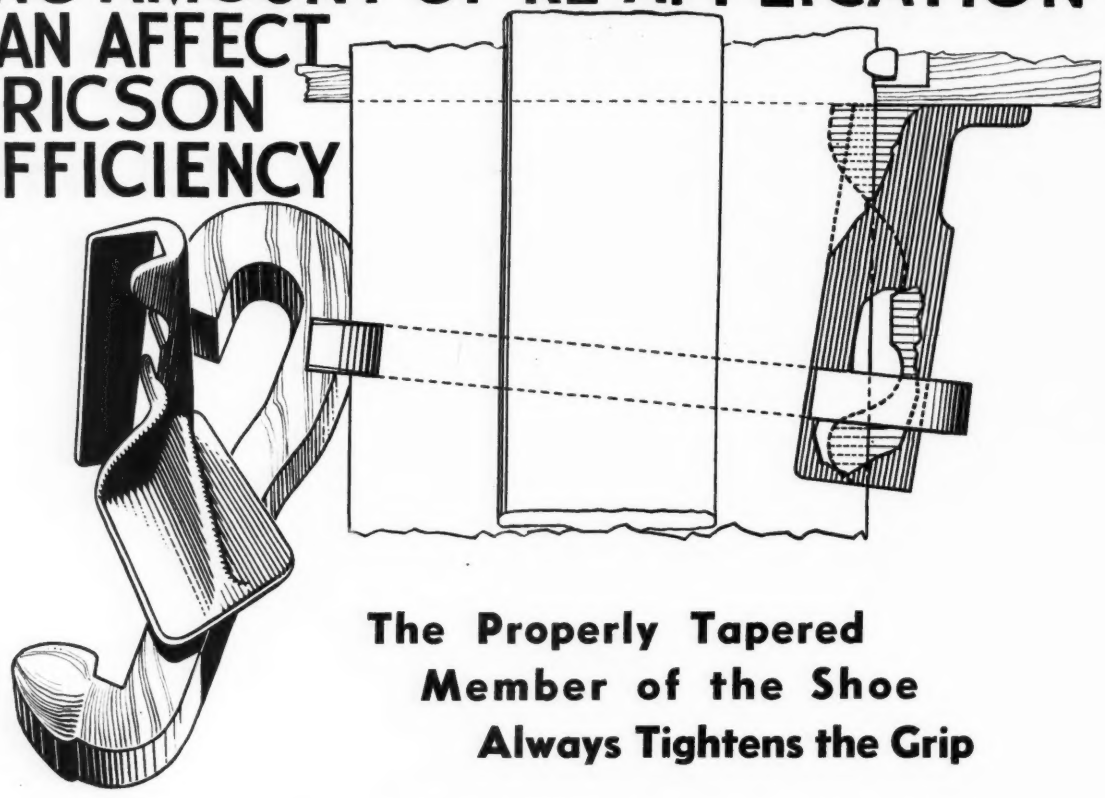

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Neither part will break or spring out of shape when removed or re-applied.

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INDUSTRIAL AND RAILROAD SUPPLY COMPANY

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JUNE, 1932

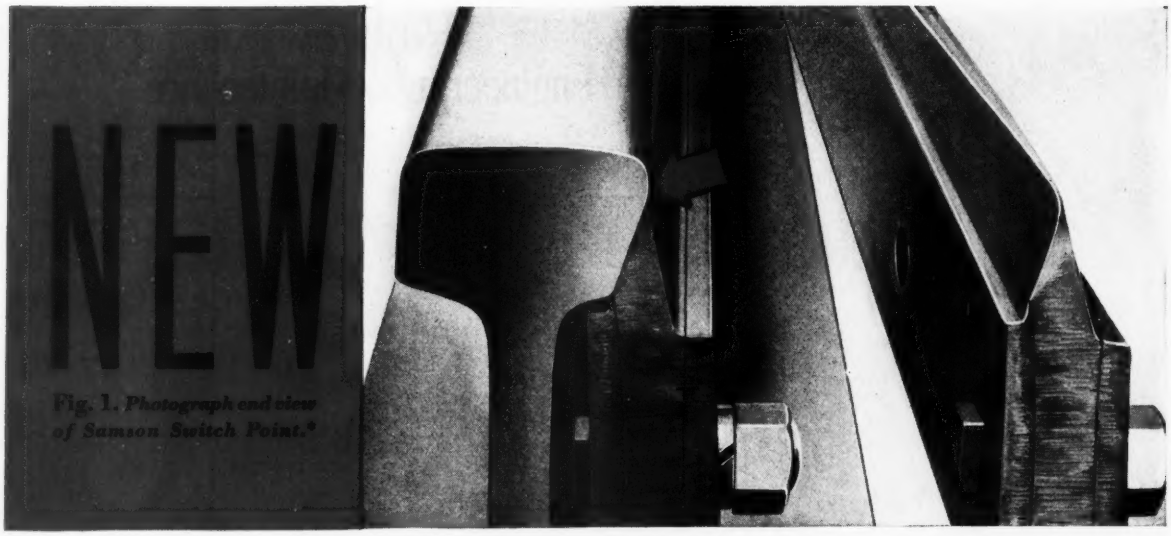

Fig. 1. *Photograph and view of Samson Switch Point.**

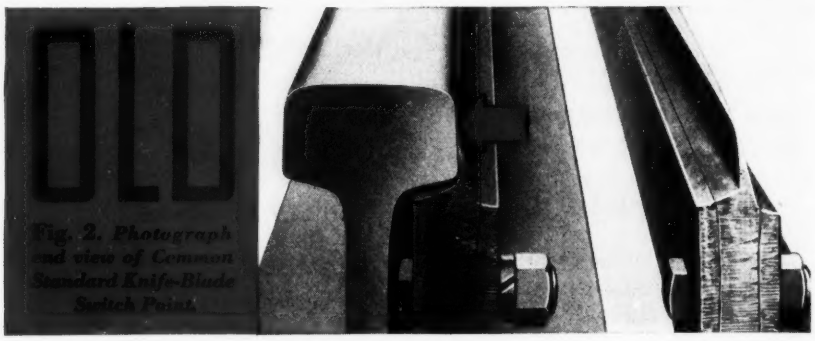

Fig. 2. *Photograph and view of Common Standard Knife-Blade Switch Point.*

THE RACOR SAMSON SWITCH POINTS*

with no extra cost . . . assure remarkable economy and added safety

WHEN considering switch points take into account that the Racor Samson Switch* means no more short life of switch points . . . no more broken down switch points . . . no more need of switch point protectors.

Samson Switch Points maintain necessary wearing surfaces to engage wheel flanges for a smooth safe passage; with them there is no danger of wheel flanges mounting on jagged wearing surfaces; they give many times the life of common standard knife-blade switches. There is probably no recent innovation in trackwork that will give a greater return on investment than the Racor Samson Switch.*

Its remarkable length of life is assured by the inverted 'V' shape of the point that fits against the undercut stock rail as shown in Fig. 1 . . . It wears smoothly and WILL NOT BREAK DOWN.

Switch points, plates and rods cost no more than old standard equipment. The cost of the stock rails, machined as illustrated in Fig. 1, is negligible when compared to increased service life. Machined stock rails can be purchased with the switch; or, if preferred, they can be satisfactorily milled in the field with a portable milling machine, operated either electrically or pneumatically from air brake pressure cylinder.

Many large railroad systems in Continental Europe have adopted universally similar switch point planing. Also many large systems in the U.S.A. have installed the Samson Switch with proof of the above claims.

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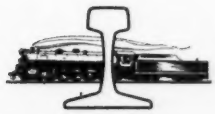
Railway Engineering and Maintenance



TAXES

Railway Employees Should Protect Their Interests

RAILWAY employment is at a low ebb. The number of persons now employed by the railways is 700,000 less than it was six years ago. In the maintenance of way department alone, the decrease is more than 200,000. Furthermore, practically all of those still in service have taken reductions in wages, and, in addition, many are working only part time. This condition is the result of the most drastic and prolonged decline in traffic ever experienced, with a corresponding decrease in the revenues of the railways, from which source alone they derive the money to pay their employees.

This decrease in traffic is the result of the slowing down of the industries which create traffic, resulting from a decrease in the buying power of other industries and individuals. This decrease in buying power is largely brought by the diversion to taxation of steadily increasing proportions of the income of individuals and industries alike.

Every railway employee has a very direct interest in the subject of taxation and in the correction of those tendencies that are affecting him so adversely. Not only is he being required to pay an increasing proportion of his earnings for taxes on such property as he may own, but he is, of necessity, paying also an indirect tax on every article which he buys. Equally or more important, the excessive drain of taxation has already thrown hundreds of thousands of his fellows out of work and is threatening the security of employment of thousands more.

The Magnitude of the Load

In order that the magnitude of the tax burden may be fully appreciated, it is pertinent to review certain facts. In 1800, when the various departments of the federal government opened their doors, the population of the United States was only 5,000,000 and these departments employed less than 125 persons. Since that time our population has increased 25 times, while the number of employees in these and other departments which have since been created has increased 4,500 times. And the growth of local and state bodies has been correspondingly great. That this trend has been especially pronounced of late years is shown by the further fact that whereas one family out of every 13 was on a tax-supported payroll 10 years ago, one out of every 10 is so supported today.

The tax bill today for the support of our 250,000 local, state and national tax spending bodies approximates $30,000 for every minute of the 24 hours of every day of the year. The total tax bills this year will approximate 14 billion dollars, to be taken from a total national income of less than 45 billion dollars. In other words, nearly one-third of the total income of individuals and industries alike will be required to support "tax eaters." Expressed in another way, prior to the war, a man was required to work the equivalent of 25 days a year for the support of our various governments. By 1924 this demand had risen to 46 days a year, and this year he will be required to work 61 days. In other words, every person gainfully employed is now spending more than one day of every week working for the support of the government.

Where Does the Money Go?

These vast expenditures go in part for the payment of pensions and other expenses of past wars. They go likewise for the support of our army and navy and of the machinery for the maintenance of law and order in our communities. They go also for the maintenance of a vast collection of bureaus and activities which, in these days of greatly curtailed individual income, should be subjected to the most critical scrutiny. For illustration, our government printed and distributed last year a total of 60,270,000 bulletins and pamphlets telling us, among other topics, how to build a hen house, how to hang curtains in our homes, etc. Coming closer to the railways, the appropriations for the Interstate Commerce Commission have risen from $5,732,672 in 1920 to $9,412,473 in 1932, an increase of 64 per cent in 12 years.

Facing such a situation, it is not surprising that we are hearing today of tax strikes and organized revolts against the payment of taxes. Even where such organized movements do not exist, there is ample evidence that the cost of government has risen beyond the ability of the people to pay in the fact that more than 50 per cent of the levies in some of our larger cities are overdue and unpaid and that in at least one southern state 40 per cent of the property is said to be in arrears and subject to sale for taxes.

Two Ways to Meet the Situation

There are two ways to meet such a situation. One is to reduce expenses; the other is to levy additional taxes. Congress is now working on both alternatives. It is, however, showing greater interest in devising new ways of increasing the tax burden than it is of severing office holders from their positions and otherwise reduc-

ing expenditures through the elimination of activities of questionable value. This is in spite of the public statement by the President that it is entirely feasible to reduce federal expenditures by $700,000,000 a year.

In the discussion of ways to increase income through taxation, the public, and especially railway employees, are facing a new and most serious threat. Under the guise of unemployment relief, numerous raids on the public treasury are being advocated, ignoring the fact that unemployment did not arise through reductions in public payrolls and that there can be no permanent solution other than by co-operating with private industry to the point where it can again become active and put back to work the men who are now on the streets. What is needed is *less* rather than more public spending in order that private industry may divert the money thus saved from taxation to the resumption of work that will itself provide employment.

If all of the bills now before Congress should be approved, they would appropriate more than $10,500,000,000 for "public work" of a wide variety. One such bill contemplates, among other items, the construction of post offices in some 4,500 communities, for which buildings plans have not yet been prepared or property secured. Other bills contemplate the expenditure of many millions of public funds for still more highways, while the chief of engineers in charge of inland waterway development is credited with the statement that $500,000,000 of additional waterway projects are "entirely justifiable."

These various projects, if approved, will add still further to our tax requirements to the extent of $600,000,000 or more annually for interest and sinking fund. Furthermore, although advocated as measures for the relief of unemployment, such activities give rise to surprisingly limited employment as was shown last year when it is said that less than 60,000 persons were employed at any one time on $750,000,000 of public construction.

By way of contrast, the Pennsylvania railroad, through a loan of $27,500,000 authorized by the Reconstruction Finance Corporation during the last month, is enabled to provide employment, directly and indirectly, for a large number of men in the continuation of its program of electrification between New York and Washington and this without any cost to the taxpayer since the railway pays to the government interest on the loan in excess of that which the government itself pays to those from whom it borrows the money. It is co-operation of this character for projects that are self-liquidating and that provide equal or greater employment than "public works" that the President is championing. It is such a program that railway employees and others menaced by rising taxes should urge in their own interest, rather than "pork barrel" projects designed to benefit local groups or local areas at the expense of the taxpayers as a whole.

A Platform

In any study of the present situation certain facts stand out clearly in their effects on railway employees:

1. The present widespread unemployment in railway service and elsewhere has resulted from stagnation in industry, not in governmental activities or public works.

2. This stagnation has come about largely from the slow strangulation of industry through the increasing diversion of private income for public taxes.

3. Permanent and effectual relief can come only through the reversal of this process—namely, reducing the tax burden and releasing a larger part of our income for employment-producing activities.

4. Such governmental aid as is devised should be self-liquidating without added burden to the taxpayer, and so far as possible should be brought to the aid of private business to assist it in resuming its normal processes of production and employment.

5. Every possible effort should be made to reduce government activities (local, state and national) to the bare essentials and to curtail or eliminate all those activities that are not immediately necessary to the public welfare.

A Course of Action

To those railway employees who believe in these measures, a course of action is open. This course is to express in no uncertain terms to those who represent them in Congress, in the state legislatures and in the local village or city governments, the fact that they expected and insisted that those steps be taken which are essential to the restoration of business. Especially is it important that national congressmen (both senators and representatives) in Washington be communicated with promptly for they are now drafting legislation that will do much to bring to an end or to prolong the present period of business stagnation.

WATER TREATMENT

An Achievement that Must Not Fail

THE article on the water treatment program of the Baltimore & Ohio, appearing on page 384 of this issue, offers a measure of the development that has taken place in this phase of railway transportation in the last few years and affords further evidence of the growing appreciation of the managements of the importance of good boiler waters. However, a water-treating plant is not like a bridge, which retains its value so long as it is kept in repair. Any system of water conditioning, whether it involves softening plants, roadside dosing plants or interior treatment must be given constant supervision to insure that the desired economies will be realized from month to month.

Investment in treating equipment or materials is justified on the basis of demonstrated savings that have been realized in earlier installations, but it is not safe to assume that after a given installation has once been placed in service or a given type of treatment adopted, it will produce the anticipated economies automatically. Steps must be taken to ascertain that all the elements of locomotive operation and boiler and firebox maintenance that may be influenced favorably by treatment are actually affected to a degree that affords ample assurance that the economies accruing are real rather than theoretical. More than this, every complaint must

be run down—not with the obvious intent of setting up a defense for the treatment but with the clearly evident purpose of getting at the facts.

It is characteristic of the history of water treatment throughout the 30 years that it has been a factor in railway operation, that unflagging supervision is the price of success. But in these days of severe stress there is a constant pressure for retrenchment—for reductions in the supervision of treatment, for the shutting down of treating plants, or for the substitution of one kind of boiler treatment for another that costs less. Any of these measures affords a means of showing an immediate saving but all of them may easily give rise to actual losses that will more than offset the reduction in expenditures charged to treatment.

USEFUL LIFE

Losses Begin Quickly Beyond Its Limit

UNDER the conditions with which the railways are confronted at present there is a natural tendency to utilize second-hand materials to a greater extent than would be done normally. While it is always desirable to obtain the full service life from any material, it is possible under the pressure of circumstances to overstep the limits of economy and good practice in an effort to get still more use out of it.

The use of second-hand track spikes furnishes an example of the undesirable effects and loss which result from an effort to keep material in service after it has served its useful life. The track spike is used as an illustration because it is a simple device which has no parts to get out of adjustment and is not subject to deterioration from wear or decay in the same degree as many other classes of material. Yet the use of spikes which have lost only a small part of their original metal, may cause other losses which far overshadow any savings that might thus be made.

Probably the most direct effect of the use of worn spikes is irregular gage. Irregular gage soon makes itself felt in irregular line and this in turn quickly extends to irregularities in the surface and cross level. As a result, track with irregular gage cannot be kept in proper line and surface and does not ride smoothly. Furthermore, the lateral play of the rail which worn spikes allow increases the mechanical wear on the ties, even where tie plates of ample size are in use, thus measurably shortening their life. Again, the small amount of lateral play which is provided by worn spikes when used in sufficient numbers, is sufficient to permit the rail to kink in the spikes if it becomes tight, while it will show a greater tendency to creep than if the spikes have a snug fit.

It is apparent that the relatively small saving that can be effected through the use of worn spikes, as compared with new material, may not only be erased, but that actual losses of greater magnitude in both labor and material may result from this practice. This should not be taken to indicate that the use of straight second-hand spikes of full section is considered uneconomical. It is only intended to point out, through the use of this illustration, that apparent economies are often misleading and that a practice which involves the use of second-hand material of any character beyond the usual limit, should be given the closest scrutiny and its results followed to a logical conclusion before it is put into effect.

BUILDINGS

Important Element of the Fixed Property

FEW persons, even among well-informed railway officers, have any comprehensive idea of the magnitude of the railway building field. Yet when it is considered that the railways of the United States, Canada and Mexico maintain currently more than 370,000 buildings, which represent an investment of $1,680,000,000, it will be seen that these structures constitute an important element of the fixed property of the railways. Furthermore, under normal conditions, the railways spend $92,000,000 annually for the purpose of maintaining these buildings, in addition to $90,000,000 for their enlargement and improvement and for new buildings.

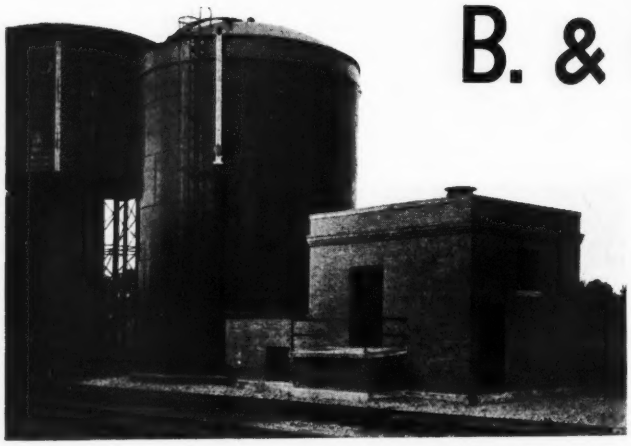
In some respects the railway building field differs from that in other industries. Railway buildings must be designed and maintained for a wide variety of uses, while rapidly changing conditions of traffic and methods of operation tend to make many of them obsolete long before they have attained their normal life. As a result, the amount of rebuilding and remodeling that is necessary is far greater than in any other industry.

As a consequence of the widely varying demands of railway service, more than 100 distinct types of buildings are required, some of which are found in no other industry. This great diversity in the types of railway buildings and the differences in design to secure architectural effect or to meet climatic conditions and service requirements, create a still wider variation in the classes of materials entering into their construction, as well as in the equipment which must be installed in them.

It is a remarkable fact that there are almost no materials of construction which do not find some application in the railway building field. Like-wise, there is little or no equipment designed for buildings which is not used in railway buildings, in addition to which many special forms of equipment are required. The requirements for materials include the entire range for both exterior and interior use. The demands for equipment comprise heating, lighting, power ventilation, sanitation, provision for hot and cold water and water for drinking, refrigeration, cooking and serving meals, furniture and furnishings, elevating and conveying machinery, weighing, fire protection and many other types of equipment for a wide variety of purposes.

By reason of the great diversity in railway building requirements, building engineers and their staffs, as well as the local building officers, must, of necessity, be constantly on the alert to keep abreast of developments in materials and equipment to insure that the structures which they design and maintain will not only demonstrate economy in first cost but that they will also perform efficiently the functions for which they were designed.

B. & O. Is "Sold" on



The Treating Plant at Mt. Vernon, Ohio, Which Is Typical of Many of the Smaller Plants on the System

Has installed over 113 plants and many automatic electric pumping units since 1923 with excellent results

THE last seven years have witnessed a revolution in the condition of the locomotive water supplies on the Baltimore & Ohio that is as complete and possibly as effective in its results as any program of water supply improvements that has ever been made on any other road in a similar period of time. The extent of the improvements, which have been largely in the form of water treatment and improved pumping facilities, is seen in the fact that 113 treating plants have been put in operation on the road since 1923, and automatic electric pumping has been established at 58 points within that same period.

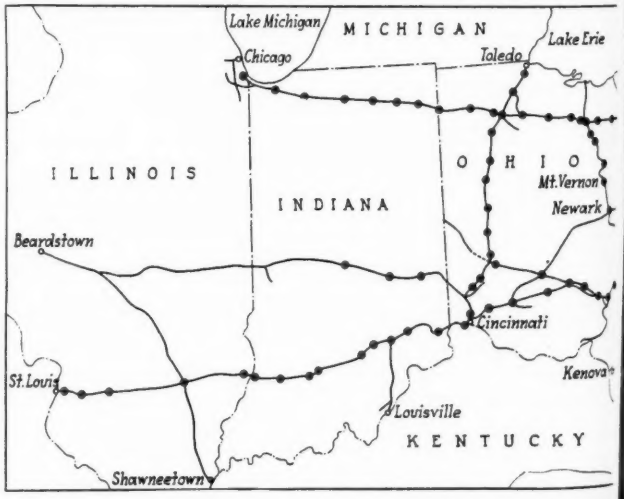
Under normal conditions, approximately 19½ million gallons of water are treated daily on the B. & O., from which it is estimated that approximately 28,700 lb. of incrusting solids and mud are removed. On this basis, approximately 4,675 tons of such solids are being removed each year from the boiler waters used on the road. Applying a most conservative estimate of the savings made in locomotive boiler maintenance for each pound of incrusting materials and mud removed, the total annual saving being effected on the B. & O. runs well over $1,000,000, on an investment in treating plants and equipment of about $3,000,000. On one division of the road, it has been established definitely that the savings effected in a year of normal operations, as a result of the complete treatment of all bad waters used, except at a few branch line points, exceeds by at least one-quarter the total capital investment in treating plants on the division.

The water problem on the B. & O. has always been mainly one of quality rather than quantity, sufficient supplies generally being available from rivers and streams and natural or artificial lakes, with recourse to wells or municipal supplies at only a limited number of points. Except for a few specific sections of the road, such as the Connellsville division and the east end of the Baltimore division, where fairly good natural waters are available, the normal water supplies are either hard or periodically acid in character. Waters containing both carbonate and sulphate hardness are encountered extensively in Ohio and Indiana, and especially in the western part of Ohio where the surface supplies contain from 5 to 25 grains of hardness. On the Toledo division, which extends from Toledo to Cincinnati, Ohio, a distance of 190 miles, the natural waters available for locomotive boiler water supplies contain an average hardness of about 15 grains per gallon.

The worst acid water conditions prevail throughout West Virginia, although considerable trouble with such water is also experienced in certain sections of Pennsylvania, particularly in the Pittsburgh territory. This situation is brought about largely by mine drainage. The degree of acidity of the waters varies largely with the stage of the supplies, ranging from slightly alkaline in some cases during periods of heavy rainfall and high water, to as much as 8 to 10 grains of acidity per gallon in periods of drought. At many points, both acidity and hardness are encountered, and, not infrequently, a considerable amount of silt must be contended with. At the Evitts treating plant, at Cumberland, Md., where water is taken from the Potomac river, acidity is not a problem, but in addition to about 5 grains of hardness, the water contains as much as 50 grains per gal. of mud during certain days of the year. The average mud content over the year approximates only 7 grains per gal., but on one day in 1929, tests showed it to be 67½ grains.

Expansion of Treating Programmed Carefully

Prior to 1924, there were only nine treating plants on the B. & O., although wayside treatment had been introduced at a number of points. The first plant on the road was constructed at Glenwood, Pa., in 1905. This plant, which has a capacity of 90,000 gal. per hr., and which is called upon to handle unusually hard water at times, is still in operation and is in first class condition. Filling a critical need at this point for so many years, the exact number of times that this plant has paid for itself through reduced boiler maintenance and increased operating



General Map of the Baltimore & Ohio.

Water Treatment

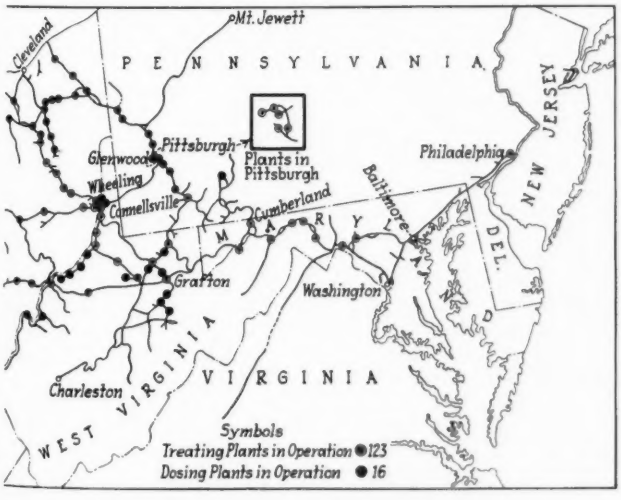
economies is a matter for conjecture, and yet it is estimated conservatively that this must be at least a dozen or more times.

Until 1923, locomotive boiler waters on the B. & O. had been treated only where the need seemed most urgent, but in that year a policy of providing water treatment on a division or district basis was established and a definite start was made in equipping the Toledo division. This line was selected for the first complete division installation both because of the hardness of the water encountered at many points, averaging 15 grains per gallon, and because of the character of the engine runs over the division, which confined the power strictly to the division where it could operate entirely on treated or naturally soft water. This latter factor was considered of importance in order that a definite check could be made on the benefits derived through the use of soft water exclusively. One plant had been installed on the division in 1922, but by the end of 1924 there were 13 plants in operation, treating all main line water supplies which were not naturally soft and alkaline in character.

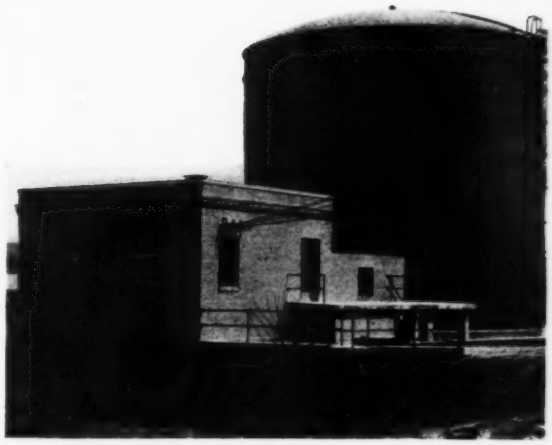
Benefits Become Evident

The benefits of water treatment on this division became evident almost immediately following the completion of the treating plants, with the result that at the end of the first year of treatment on a division basis, it was estimated that the entire cost of all of the 13 plants had been more than offset by the savings which had been made through reduced boiler maintenance and improved locomotive performance. During the two years immediately following the completion of the facilities on this division, effort was concentrated largely on improving the conditions at a few points of particularly bad water, but at the same time, a special committee, consisting of the engineer of tests, representing the motive power department, the engineer of buildings, representing the construction department, and an assistant engineer, representing the maintenance of way department, was at work formulating a consistent program of water treatment for other divisions of the road.

The program developed by this committee, which was



Showing Location of Treating Plants and Way-Side Treating Stations



The Treating Plant at Newark, Ohio, Where the Primary Supply Pumps Are Housed in a Sub-Basement Level

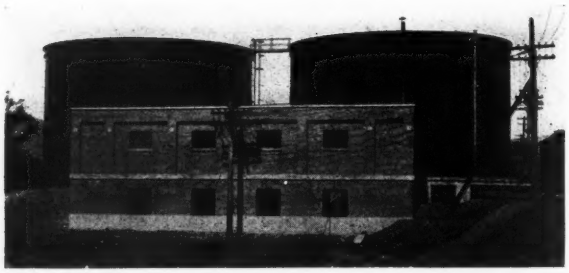
built up on a yearly basis, resulted in the complete treatment of bad waters on the Akron-Chicago division in 1927; the establishment of complete treatment on the Pittsburgh and Cumberland divisions and on the west end of the Baltimore division in 1928, in addition to the installation of plants at certain points on the Wheeling-Cleveland line of the Akron division; and the complete treatment of bad waters on the Ohio and Newark divisions, and on the east end of the St. Louis division during 1929. In 1930, treating plants were established where necessary on the west end of the St. Louis division and at a few points on the Indianapolis and Mononga divisions.

Including those territories where good waters are available naturally, such as the east end of the Baltimore division and a portion of the Connellsville division, the completion of the 1930 program resulted in the road being assured of good boiler water from Philadelphia to Chicago, and from Cumberland to St. Louis, Mo. At the present time, approximately 90 per cent of all naturally objectionable waters used for boiler purposes on the road are treated, and to complete the system program for practically 100 per cent treatment calls for the construction of only six more treating plants.

Supplementing the work carried forward on the main line during these years, treatment was established at a number of branch line points. In most of these cases, however, the expense of treating plants was avoided through the provision of wayside treating equipment, designed to treat the water directly as delivered to locomotives.

Improved Pumping Facilities

In conjunction with the program of water treatment carried out, pumping stations were eliminated where possible; new stations were established in certain instances to replace two or more existing stations, and in other instances to obviate the necessity for purchasing water; water service buildings were improved generally, all new buildings being of a permanent fireproof character; and the pumping equipment was modernized at a large number of points. Anticipating the probability of longer engine runs in the future, with fewer water and coal stops, the program for 1929 and 1930 gave particular attention to the location of water stations and to the character and capacity of the stations to be built at specific points. That there was a considerable readjustment and consolidation of water points on the road is seen in the fact that approximately 36 water stations



The 150,000-Gal. Per Hr. Treating Plant at Evitts (Cumberland, Md.)

were eliminated during the last four or five years. Altogether, the improvements have cost in the neighborhood of $4,000,000, of which amount approximately 70 to 75 per cent was for treating plants and 25 to 30 per cent for general improvements to water service buildings and pumping equipment.

Lime-Soda Treatment Predominates

With only two major classes of bad waters on the B. & O., acid and hard waters, both of which can be treated successfully by the lime-soda ash process, which is also effective in removing silt, this method of treatment has been adopted extensively. As a matter of fact, of the 123 plants on the system, 115 are of this type, while 8 are of the zeolite type. The lime and soda plants, which are mainly of the Graver, American Water Softener and Roberts water motor types, are more or less similar in appearance and design, varying principally in the method of chemical control. Essentially, they include a treating tank and a treating plant building housing one or more chemical mixing vats, a supply of dry chemicals and the necessary piping and chemical proportioning equipment.

The chemical proportioning equipment at the different plants is of the meter-electric, the meter-mechanical and the water-motor control types. In the first two types, which are relatively new, a special meter in the raw water line is instrumental in proportioning the dose of chemicals to the volume of water pumped, one through electrical control of the proportioning equipment, and the other through the mechanical control of the equipment. In the last mentioned type, which has been in common use for a number of years, a water motor, which is tapped into the supply line, pumps the chemicals to the treating tank in direct proportion to the volume of raw water delivered to the tank. In the meter types of proportioning, a small capacity electric motor operates the agitator in the chemical mixing vat and pumps the chemicals to the treating tank, while in the water-motor type both of these operations are performed by the water motor itself.

The Interior of the Chemical Storage Floor at the Evitts Plant, Showing the Chemical Charging Holes in the Floor

The treating tanks provided are largely of the standpipe type, ranging in capacity from 50,000 gal. at certain of the smaller stations to as much as 250,000 gal. at the larger stations, although some conical and spherical bottom tanks have been used in special cases. At many points, tower-type tanks are provided for treated water storage, but at at least as many points, the storage tank has been eliminated by providing a treating tank of adequate size to hold a sufficient amount of clear treated water above the capacity required to insure thorough treatment.

The design of the standpipes for such installations provide that the downcommer shall be of sufficient size that the water will be retained in it at least 20 min. in passing from top to bottom, thereby insuring thorough mixing of the water and the chemicals; that the rate of up-flow in the settling portion of the tank shall not exceed four feet per hour; and that the total settling period shall be at least seven hours. In addition to these definite specifications, about one foot of depth is allowed at the base of the tank for the accumulation of sludge.

On the Equipment Floor of the Meter-Controlled Treating Plant at Cumberland, Showing Details of the Layout and Equipment Used

Applying these principles of design, the combination treating and storage tanks insure thoroughly treated water above the seven-hour settling line, and in sufficient quantity to meet the requirements of greatest demand, without any possibility of water that is insufficiently or incompletely treated being drawn off for locomotive use. In fact, many of the newer combination treating and storage tanks provide an excess storage of treated water at the present time, having been constructed at points where old wooden supply tanks are still retained in service. This was arranged with the specific purpose of making the new treating-storage tanks handle the entire water requirements at these points after it becomes necessary to abandon the old wooden tanks.

The draw-off from the combination tanks is always from the top surface of the water, this being accomplished by means of hinged, float-type outlet, and, to prevent the possibility of overdrawing the clear, treated water supply, the float outlet is arranged to stop automatically in its downward movement directly at the seven-hour settling line of the tank.

The same principles of design and operation were incorporated in the conical and spherical bottom steel tanks used for treating purposes, and it is interesting to note that at a number of points of small demand, usually on branch lines, old existing wooden tanks, used formerly

for water storage and supply where no treatment was administered, were converted into combination treating and supply tanks by incorporating the same features of design. This required the installation of a downcommer and suitable regulating valves in the old tanks, but proved a highly economical expedient where treatment of the water was desirable, and yet where the condition of the wooden tanks and the limited water consumption did not fully justify the installation of new tanks.

Interesting Features in Building Construction

In most cases on the B. & O., owing to the relation of the sources of supply to the points of delivery of the treated water, the treating equipment and the primary water pumps are housed in separate structures, although in a few special cases it was possible to install the supply pumps in a suitable sub-basement or well in the building housing the treating equipment. With pumping plant buildings already established at most points, most of the work of recent years has been that of constructing plant buildings. While individual buildings were adapted to meet any special requirements that were presented, in general, they are of the same type of construction, with concrete foundations and floors, brick walls, steel window sash, and steel beam ceilings supporting cement tile roofs covered with insulating board and composition roofing.

One of the main features of design incorporated in the buildings wherever possible, was that of two floor levels, one at car-floor height for the storage and handling of chemicals, and the other, usually about 10 ft. lower, for housing the chemical mixing tank, the proportioning equipment and the water-supply piping and valve control systems. Through this arrangement the handling of the chemicals is greatly facilitated, since they can be trucked or carried to storage directly from cars and then dumped directly into the mixing tank beneath through openings in the storage floor, without any lifting. Furthermore, the two-story design is usually more economical of construction, unless difficult excavation is necessary in providing the lower floor.

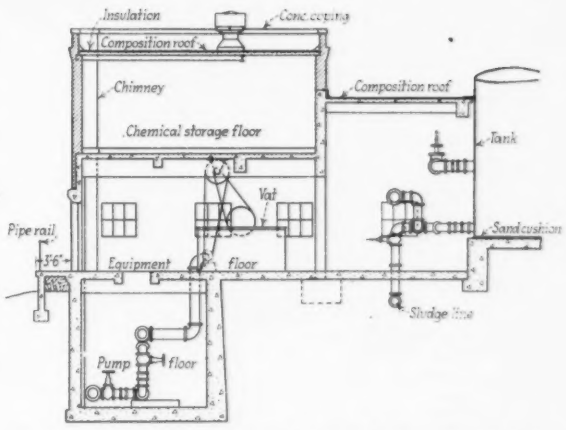
Details of Typical Plant Construction

The treating plant building at Mt. Vernon, Ohio, shown in one of the illustrations, is typical of a large number of the smaller buildings constructed. At this point, the equipment includes a 50,000-gal. steel standpipe-type treating and storage tank capable of treating 12,000 gal. of water an hour.

The Evitts lime-soda plant at Cumberland, features of which are shown in several of the illustrations, is the largest treating plant on the road, having a twin installation of treating equipment with a combined capacity for treating 150,000 gal. of water an hour. The building incorporates the two-story feature, and varies from the one at Mt. Vernon only in its larger size, which was necessary to house the larger and increased amount of equipment and a larger supply of chemicals. At the Evitts plant, the upper floor is about 68 ft. long by 28 ft. wide and is used for the storage of chemicals, while the lower or equipment floor is somewhat larger, having been extended to the faces of the two treating tanks to include the piping and valve systems.

Details of Layout and Operation at Evitts

In the operation of the Evitts plant, water is taken from the Potomac river and is pumped to the treating plant, about 800 ft. away and at a considerably higher elevation, from which it is again pumped to a storage tank in the yard at Cumberland. Every precaution was taken

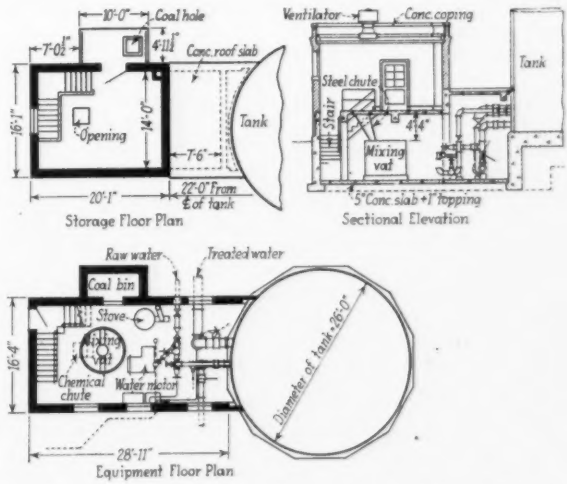


Section Through the Three-Level Treating Plant at Newark, Ohio

to insure a continuous supply of water, from the location of the river intakes to the provision of duplicate supply lines. Some of the major precautions include the twin arrangement of treating units instead of one large unit, the provision of three 1,250-gal. per min., electrically-operated centrifugal primary pumps, one a spare, and the provision of a similar set of three delivery pumps in the basement of the treating plant. Furthermore, while both treating units are ordinarily operated together as a single unit, the piping and valve arrangements are such that either unit can be taken out of service temporarily without affecting the operation of the other. In addition, any two of the units in the sets of primary and delivery pumps can be operated together, and can pump water through either or both of the supply lines.

The pumping plant at Evitts, like the treating plant, is of concrete and brick construction, and is provided with two river intakes. The most interesting feature of the plant is the fact that the pumps are set at an elevation below low water in the river, a feature which eliminates suction lift and the necessity for check valves on both sides of the pumps, in this case on duplicate intake and delivery lines. Furthermore, this low-level setting of the pumps introduces a wash-back feature in the system, which is of assistance in cleaning the lines and in blowing back any accumulation of silt or debris at the intakes.

The treating plant at Newark, Ohio, shown in one of the illustrations, is one of the few plants on the road



Floor Plans and Section Through the Small Treating Plant at Mt. Vernon, Ohio

where it was possible to house the primary supply pumps and treating equipment in the same building.

As already indicated, the improvement of pumping facilities went hand in hand with the large program of water treatment, this phase of the work being designed to minimize pumping costs, and, in a number of specific instances, to secure a larger or more dependable supply. Prior to 1924, the majority of the pumping plants were steam-operated, although internal combustion engines were in use at a number of points, while in recent years, with the greater availability of electric power, the trend has been almost entirely toward the use of motor-driven pumping units, principally centrifugal pumps. Going a step further, automatic electric operation has been installed where feasible, 58 such installations, of a total of 72 automatically operated and controlled plants on the road, having been placed in operation since 1923.

That the savings being effected through this type of operation and improved pumping equipment are large is not questioned on the B. & O., in spite of the fact that pumping cost statistics have never been compiled for the road as a whole. Roughly, the total savings are estimated at about $150,000 a year, but more convincing than this estimate is a comparison of the cost records of individual plants before and after the improved facilities were provided. At the Evitts plant, for example, where the operating costs prior to the installation of automatic electric pumping equipment were approximately $25,000 annually, they are now only about $9,000. Furthermore, it is known definitely that the present total pumping and treating costs at this plant are well below the cost of pumping the untreated water before the improvements were made.

Operation of the Treating Plants

While there are still a number of pumping and treating plants on the B. & O. which require full-time attendants owing to the type of pumping equipment in use or the constantly varying character of water pumped, the installation of automatic electric pumping, combined with treating equipment which is automatic in operation except for the charging of the chemical vats, has made it possible to put treating plant attendance on a part-time basis at a large number of points. At these plants, the routine work, which consists largely of making periodic tests of the character of the water being pumped and the preparation of chemical charges, is usually assigned to a regular employee, such as a section foreman or station agent, who can give the necessary amount of time each day to treating plant duties, either within or after regular working hours.

Ordinarily, the amount of time required at the plants is confined to one visit daily and ranges from a few minutes to about an hour, depending upon the size of the plant and the character of water tests necessary. The main factor in determining the frequency with which a plant must be visited is the degree of stability in the character of water pumped, since practically all of the plants are so designed that a single charge of chemicals is sufficient to permit treatment over a period of 24 hours. At many points, where changes in the character of the raw water are seasoned or gradual, one visit of the attendant each day is sufficient, but at other points, where the character of the water is known to change frequently and rapidly, two or more visits may be required of the attendant daily to make water tests. Ordinarily, the soap test alone is required, following which adjustments are made in the rate of chemical dosage if necessary.

The intermediate daily visits to many of the plants consume a considerable amount of time, but are much more economical than maintaining full-time attendants, and at the same time, insure, within practical limits, that a degree of treatment commensurate with the character of the water pumped will be maintained. To do other than make periodic daily tests of the water pumped at certain plants on the road would, to a large extent, reduce the ultimate effectiveness of these plants and, in most cases, result in under or over treatment of the water during certain periods of each day.

A check on the work of the plant attendants and the character of the water pumped at the different plants is maintained through weekly reports of daily operations required of the attendants. Furthermore, a corps of water service inspectors representing the engineer of tests, are constantly on the road visiting the different plants periodically and going over the individual water problems at each plant with the plant attendants. Minor adjustments of the mechanical and electrical equipment at the plants are frequently taken care of by the attendants, but all major adjustments and repairs are made by regular division repair forces.

Marked Effect on Locomotive Maintenance

All evidence and statistics on treating plant operation and the results being effected on the B. & O. point to tangible and intangible benefits of large proportions, but detailed statistics have never been compiled for the road as a whole. However, the actual economies being effected, as far as they can be determined, have been so developed at a sufficient number of individual plants, and on the Toledo division as a whole, as to remove all doubt with regard to the large return resulting from water treatment over the system.

The most outstanding effect of the general policy of water treatment has, quite naturally, been in reduced locomotive boiler maintenance and improved locomotive performance. Whereas it was necessary formerly to wash locomotive boilers over the system on an average of every 10 to 15 days, and on the Toledo division every 7 to 10 days, boiler washing periods over the road generally have been extended to 30 days, and this operation is now carried out in connection with scheduled locomotive inspection under regulations of the Interstate Commerce Commission. On the Cumberland division alone, under normal conditions, it is estimated that approximately 800 boiler washings are being eliminated each year.

The life of boiler flues and side sheets, which was greatly limited prior to the practice of water treatment owing to pitting and the accumulation of scale, has been greatly extended. On the Toledo division, for example, flue life ranged from about 8 to 13 months and complete new sets of flues were required after about 13 months of service, whereas the life of flues has now been extended to about four years.

Supplementing the savings which are being effected in boiler maintenance are those being derived from more intensive locomotive utilization and, of no small importance, through a reduction in the amount of fuel consumed. The latter saving, reflecting only that part derived as a result of water treatment, is estimated at from 7 to 10 per cent.

The water service improvements described were planned and carried out under the direction of G. H. Emerson, chief of motive power and equipment; C. P. Van Gundy, engineer of tests and water engineer; H. A. Lane, chief engineer; and L. P. Kimball, engineer of buildings. The operation of the plants is carried out under the direction of Earl Stimson, chief engineer maintenance, assisted by J. T. Andrews, assistant engineer, and by Mr. Van Gundy of the motive power department, who has direct supervision over the character and extent of the treatment administered.

Left—Attendants at a Meeting of the Kansas City Southern Maintenance of Way Association.

Below—A Typical Stretch of Track on This Road

Training Foremen For Maintenance of Way Work

Group meetings for the reading of papers and general discussion have proved highly beneficial

By H. B. VESS
Editor Employees Magazine, Kansas City Southern

"THESE are the days of search for methods and devices designed to increase the efficiency of railroad operation," the Railway Age suggested in an editorial some months ago. "Never before have old methods and old practices been subject to such critical analysis and revolutionary change. The industry needs the added economy and efficiency which modern methods and machinery can give. The search for still better methods and even more economical devices must continue. But is there not yet another possible means of improving railway performance which has received comparatively little attention? We refer to educational activities to teach employees to do their own jobs better and to prepare them for promotion to more responsible positions."

Modern machinery and mechanical devices have certainly done much to increase efficiency in railroad maintenance. But with this improved machinery and the introduction and rather extensive use of mechanical labor-saving devices most railroad men will agree that, in comparison, but little attention has been given to the other "possible means of improving railway performance" suggested by the Railway Age.

The need for greater efficiency in railroad maintenance, as in all other branches of railroad operation, has been emphasized by the effects of the world-wide depression on the earnings of the railroads, and by the development of other and newer forms of transportation with which the railroads must compete for business. Transportation by rail is apparently going through a period of transition and adjustment in which the more intensive training of the personnel—the teaching of men to study their jobs, to think more about their work, to devise new and better ways of doing it—will become increasingly necessary and important, and will be given more attention.

One of the railroads which have given attention to educational activities of this nature is the Kansas City Southern. Through monthly meetings of its maintenance foremen and supervisors it has endeavored to teach them both to do their own jobs better and to teach and instruct their men in the principles of good workmanship in railroad maintenance, including the important feature of doing their work with safety to themselves and those working with them. These meetings have proved so helpful in carrying on the work that they have become an integral and important part of the maintenance department's program and organization, and the department officers would not willingly forego them.

The Need for Further Training

The average foreman in his preliminary training or experience usually has learned how to perform the various operations of track work, has acquired some judgment as to the relative importance of his various duties, and has learned to some extent the difficult art of handling men, though there are failures in this respect. But not always has he learned the reasons for doing work in certain ways—the causes of certain effects, or the effects of certain causes. He has learned many of the practices of his job, but not always does he understand the principles on which those practices are based. Nor does he always keep up with the developments in railroad maintenance or with the improved methods of doing work. Sometimes he fails to grow and develop in skill and judgment as rapidly as he might if he had the advantage of better educational opportuni-

ties, and especially of meeting his fellow maintenance men at frequent intervals and of discussing his work with them.

Section foremen are left much to themselves and their little gangs of men. In many instances they are located at isolated points with little opportunity of coming in contact with others outside of their immediate families and the men working with them. Much good comes from bringing these foremen together at intervals and, in addition to study and discussion in accordance with a definite program, letting them visit and exchange ideas among themselves. The individual foreman finds out in this way what other men are thinking and how they are working, how they are developing ways to do their work better and perhaps with less effort than he has been taught or has learned by experience in his smaller sphere of activity.

Foremen's Meetings Offer Opportunities

Foremen's meetings or conferences, well planned and properly conducted, provide opportunities to bring these men together for further teaching and training, and for overcoming the effects of their isolation, probably better than any other method which has been devised. In these meetings, which may be regarded as "continuation schools" in the training of the foremen, they gain an understanding and appreciation of the broader principles of their occupation which they do not get in their day-by-day work on the track, and had not acquired in their previous training.

The first step in planning such a method or procedure is to consider carefully the objectives or ends to be attained, and then to work out such a plan and program as will make it possible to achieve these results. The programs must be designed to fit the particular situations and meet the particular needs of the men who are to be reached. The place where the meetings are to be held, the time and facilities available, and the capacity and educational qualifications of the men themselves, all must be considered in planning the meetings.

In general, it may be assumed that these meetings will be organized on the "group conference" plan, with perhaps enough of the "lecture" and "text study" methods to make them most effective, although too much of the school-room atmosphere should be avoided. While they should be informal to encourage free and frank discussion, they should be guided along purposeful and well-defined lines and not allowed to wander aimlessly. They may be in charge of a division engineer or other officer of similar rank, or perhaps a general maintenance officer, and sometimes a roadmaster. The discussion will deal so far as possible with concrete problems which confront the foremen in the course of their work, with the idea of "developing the foremen's thinking and a more elastic state of mind." There will be a clear understanding, of course, that no one will be criticized in the meeting or later, or be penalized in any way for presenting an honest opinion of any sort. A definite program will be followed, and such aids in the way of pictures, charts, texts, and so on, will be used as are available.

A Typical Program

From the time it started its meetings, the Kansas City Southern has followed a carefully considered program, which has included both seasonal topics—referring to the work being done or about to be done at the time the meeting is held—and those dealing with the more general principles of track maintenance. There have also been included from time to time subjects looking toward the development of the foreman as a student and thinker, a better citizen, and a more thoroughly informed employee, conversant with the aims and problems of the maintenance department and of the railroad as a whole. A typical program of a meeting, which train service did not permit starting until 10:30 in the morning, is given as an example:

Morning Session

10:30 a. m.—Opening of meeting (short talk by the chairman).
10:40 a. m.—Paper, "Carrying Out the Tie Renewal Program."
Discussion.
11:30 a. m.—The Safety Situation (general discussion looking to the prevention of personal injuries, led usually by the safety supervisor.)
12:00 Noon—Adjourn for lunch.
12:15 p. m.—Lunch.

Afternoon Session

1:30 p. m.—Motion picture in four reels: "The Story of Steel rail."
2:30 p. m.—Paper, "The Inspection and Maintenance of Rail in Track."
Discussion.
3:20 p. m.—Paper, "Establishing and Maintaining Correct Elevation on Curves."
Discussion.
4:00 p. m.—The Association Forum: (Topics for brief discussion).
a—To what extent are we justified in using in side tracks rail-cut ties released from main tracks?
b—What steps should the foreman take to keep the farm gates closed on his section?
c—How should ties be tamped to give a uniform bed and reduce wear on ties and rail to the minimum?
4:45 p. m.—General Discussion (on matters the men may wish to bring up.)
5:15 p. m.—Adjournment.
5:30 p. m.—Supper.

The papers on the program are prepared and read by the men who attend the meetings: Foremen, roadmasters, assistant and division engineers, and others.

The success of these meetings demands that the programs be comprehensive and well balanced. It is therefore advisable to plan them for several months ahead, tentatively at least. This makes it possible to discuss the principles and practice of maintenance work in a systematic way, to include in the programs special subjects looking to the general development of the men, and to cover work which will be under way or about to start at the time the meetings are held. It also gives opportunity to assemble material in the way of pictures, charts, statistics, etc., for use at the different meetings. In addition, the subjects can be assigned to the men who are to write the papers in plenty of time for them to do justice to both themselves and the subjects.

Avoid Assignments That Are Too General

Some programs are weak and the meetings fail to get anywhere because the titles given papers when assigned are too general, and an outline of the subject is not given with the assignment. An example might be taken from some safety meetings. A half dozen or more men are asked to write papers on "Safety," "Safety First," "Safety in the Yard"—or in the shop, on the track, etc., with the result that the papers are more or less alike. A better way would be to pick out as the subjects for papers those hazards which are causing the most injuries, and then let the subject be covered in a general way by only one speaker.

The same sort of defect is likely to develop in meetings for the discussion of maintenance work, particularly after the meetings have been held for a year or two, and the ground has been covered in a general way. It then becomes necessary to be more specific in the selection of subjects—to approach the various classes

of work from different angles, or to take smaller sections of a subject and get to the heart of each section.

Some subjects which will and should be discussed in these meetings are best handled by specialists in those lines. The treatment of timber and its subsequent handling would best be discussed by a tie and timber man, who has studied the matter and is thoroughly familiar with the nature of timber and the chemistry of its treatment, with the causes of decay and current and approved methods of preventing or avoiding such decay. If subjects are thus handled by men who understand the theory as well as the practice of the particular branches of the work in which they have specialized, the foremen themselves will learn something of this theory, will be better able to reason from cause to effect, or back from effect to cause, and do a better job of maintenance generally.

The discussion can be better kept in line, with more assurance of getting over the entire program, if a definite schedule, such as the example already given, is arranged and followed. It is so easy for the discussion to get started off on a tangent and consume more time than its importance justifies. The presiding officer must keep a grip on the situation to see that the schedule is followed closely and that those joining in the discussion stick to the subject. If a subject cannot be covered adequately in the time allowed at one meeting, it can be carried over to the next.

Sufficient time should be allowed for the reading of the papers or articles and for a thorough discussion, depending upon the nature of the subject. A period should also be allowed for questions and the discussion of matters connected with the work under way at the time (if it is not included in the program itself) and other matters the men may have on their minds.

Writing of Papers Valuable Training

There may be some who feel that the writing of papers by the foremen is of little real value, that few new ideas or little constructive material will be presented in the average paper, and that just as good results would follow an open and general discussion of a few subjects, without the writing and reading of any papers. In this there is undoubtedly some truth, but there are at least two reasons why the preparation of papers is worth while. One of them is that a well-prepared paper serves as a spring-board for the discussions; it gives the men a place from which to start. It tends to keep the discussion within bounds. The other reason is that it does the men themselves more good to be required to write papers than simply to be invited to join in a general discussion.

Walter B. Pitkin, of the department of journalism of Columbia University, suggests that no one truly knows a thing unless and until he has expressed it—that nobody truly understands anything whatever until and unless he has told and explained it to somebody. Let a man sit down to put on paper what he knows about a subject, and quite often he will find that he has only a hazy notion of it. The track foreman or supervisor who has expressed himself on a subject to the best of his ability has a surer and more certain knowledge and grasp of that subject than has the man who has never attempted to analyze or put down on paper what he really knows about it.

Better papers will be had, as a rule, if the subjects for papers and the men who are to write them are carefully selected. Most often, perhaps, men who are most proficient in a particular class of work are selected to discuss it in writing. But it is sometimes desirable to request men to write papers covering classes of work on which they are weak, or on which they have been slow to adopt new methods or changed standards. The old-time foreman who insists on surfacing ties in when making tie renewals, or the roadmaster who permits it, on railroads where the standard is to dig them out and in, might be assigned to prepare a paper on methods of making tie renewals; the man who insists on throwing dirt over the top of the cut in ditching, to be washed back into the ditch at the first heavy rain, might be asked to write on keeping the track ditches open. The subjects will be more fully covered if the desired scope of the papers is outlined when the assignments are made to the men who are to write on them. The outline of a subject given a man when he is assigned to write a paper on that subject need not be elaborate. It should mention the points to be covered—principles, practice, and results—but it should not tell the writer what to say or what opinions to express.

One thing that is helpful, both in promoting discussion and in keeping it in line, is to mimeograph the papers which are to be read. The papers can be sent in to the secretary a week before the meeting, mimeographed and bound with staples, together with a copy of the program or schedule of subjects. A sufficient number of copies should be run off to send one copy to each man who is to attend, and have a sufficient number on hand at the meeting to supply those who did not bring their copies with them.

Papers Should Be Edited

When the papers are received in the office before the meeting, and before they are mimeographed, they should be gone over carefully by the chairman or secretary, and such revisions made as are necessary for clearness and correctness—not with a view of discouraging the writer but to encourage him by constructive criticism. Most men appreciate having their papers edited, so long as the sense of the papers is not changed, and the opinions they have expressed are not distorted.

It is sometimes desirable, in assigning the subjects, to designate someone to lead the discussion on each paper as it is read. This man gets a copy of the paper several days or a week in advance of the meeting, and comes prepared to open and lead the discussion on it. Another plan is to ask several men to get up in turn and discuss some parts of the paper. In this way the ice is broken and the subject can then be thrown open for general discussion. If a stenographic report of the proceedings of a meeting is made, it is customary to transcribe it in full or as nearly so as the stenographer can get it. A desirable variation, when it can be done, and especially when the proceedings are to be printed, is to have them rewritten from the stenographic transcript in narrative form. In this way important points can be given greater emphasis, with references to various conditions, instructions or standards, and the proceedings made more complete, interesting and helpful.

Perhaps it is not too much to say that the success of these foremen's meetings depends almost entirely upon the leadership—upon the thought put into the preparation of the programs and the manner in which the meetings are conducted. The chairman or presiding officer should be thoroughly in accord with the spirit and familiar with the object of the meetings; he should have studied the papers and have given mature thought to the subjects on the program and should be able to so stimulate and guide the discussion as to encourage the men to think constructively about their work and take an active part and interest in the meetings.

It is better for the chairman not to say too much at the beginning of the discussion of a paper; he should withhold his comment until the discussion on the paper seems to be over, and should then sum up briefly what has been said, cover anything overlooked and make his own comments. At the opening of the meeting and before the first paper is read, the chairman can and should say something of the happenings and performance of the previous month; and at the close he may outline the work for the following month or the immediate future, and if he wishes, tell some of his plans.

For a time after the meetings are inaugurated, there is always much to talk about, and it is not difficult to hold the interest of the men. But after the meetings have been in progress for a year or two it becomes necessary to introduce some innovations into the meetings to hold the interest. And it is now, if it has not been done before, that the leader can introduce more of the educative process into the conduct of the meetings. He has already covered the ground in a general way, and can now proceed to go into greater detail, to analyze the subjects more closely, to really study the principles underlying railroad maintenance, and translate them into practice.

One of the aids to this more educative type of meeting is the preparation of texts in which are outlined the principles and desirable practices of the different classes of work. These texts may be prepared from the existing standards of the road, and supplemented for the sake of completeness by material adapted from other sources. Thus, a pamphlet may be prepared—preferably in mimeograph form—covering the principles of roadbed construction and maintenance, describing the different types of soil on the division or the railroad, telling how squeezes, slides and other undesirable situations develop, and suggesting the remedy. Another would deal with ballast; still another with ties, and so on through all the various classes of maintenance work.

Pictures Are Valuable Aids

The Chinese have a proverb to the effect that "one picture is worth ten thousand words." Certainly in these foremen's meetings the use of pictures, sketches, charts, etc., will do much to illuminate a subject and aid in its easier comprehension. These may be motion pictures, slides, ordinary photographs, or homemade charts and sketches which the chairman himself or some of his assistants may prepare.

Numerous motion pictures are available from the manufacturers of railway materials and others, and may be obtained from various exchanges—such as the Y. M. C. A. Motion Picture Bureau, the U. S. Bureau of Mines, etc. without cost other than the payment of transportation charges, or in some cases a small rental fee. Some of the larger railroads employ a photographer, and include in his equipment a motion picture camera which can often be utilized for making pictures of work in progress, of the right and wrong ways of performing different classes of work, etc. Such pictures often get the point across better than could be done in any other way.

Ordinary photographs of work in progress, or of various conditions and situations which it is desired to bring to the attention of the men, may be used to advantage. These pictures may be shown either by means of slides made from them, or by using one of several projectors on the market which will show the photograph itself. Pictures used in the latter way should be pasted on heavy cardboard so they will not curl up under the heat on the inside of the projector. These projectors use pictures of any of the standard sizes, those of post card size perhaps being most desirable, but sketches, charts, pictures and clippings from magazines and newspapers, and other material up to about 6 in. by 9 in. may be used satisfactorily.

Where the use of equipment of this character is not available, a desirable substitute will be found in the use of a blackboard, or a pad of large sheets of paper, upon which diagrams and figures may be drawn. In the case of unusual situations and recommended treatments, the necessary sketches may be prepared beforehand by the engineers or those having to do with the particular problems involved. The chairman can note down and organize on this blackboard or paper chart the important points brought up, and draw attention to them in summing up the discussion on a paper. Sometimes the men themselves will want to use the blackboard or paper for making a sketch to illustrate a point they are trying to bring out, or to picture some device they recommend.

It is desirable occasionally to have men from other departments—transportation, mechanical, accounting, purchasing, fuel, legal, public relations, etc.—talk at these meetings and tell something of the work of their departments, thus giving the foremen a better understanding of the work of the railroad as a whole and of their relation to it.

Nothing has been said so far about "field work," and in some cases nothing of the kind can be attempted. In other cases, however, where the meetings are held not far from the railroad yards, a stretch of track or part of the yard may be set aside for an hour or two of practical demonstration of some of the principles and practices which have been discussed in the meetings.

The Duties of a Secretary

The administrative details of the meetings are best handled by a secretary assigned to that work. He may or may not devote his entire time to it, depending upon the extent of these activities and the number and frequency of the meetings. He should familiarize himself with current practices in training foremen, keep himself informed of new ideas and methods, and be able to suggest practices which will add to the interest and effectiveness of the meetings. The secretary will plan the program—after consultation with and subject to the approval of the chairman—look after the assigning of papers and assembling of material of various kinds for use at the meetings, edit the papers when they are received and have them mimeographed, and will also make whatever local arrangements are necessary for the holding of the meetings. He will keep the record of the meetings, taking the report himself if he is a stenographer, and see that it is published in suitable form and distributed. Unless some one is assigned to look after these details they are likely to become burdensome to the chairman or presiding officer, because of the press of other and perhaps more important duties.

The suggestions contained in this article, based in general on the practice of the Kansas City Southern in furthering the training of its maintenance foremen through periodical "maintenance meetings," are offered because of the dearth of material on the subject which has appeared in print, and a feeling that a body of some such material should be developed. It is the hope that its publication will bring from other railroads or organizations comments and suggestions from their practices and experience which will be helpful to railroad officers generally who are interested in improving railway performance through "educational activities to teach employees to do their own jobs better."

Stopping Slides With an Effective Drainage System

Protracted troubles in a high fill at Sibley, Mo., overcome by grid of pipe lines under the roadbed

End of One of the Outfall Drains at the Foot of the Embankment

THE installation of a system of roadbed drainage has been effective in overcoming the serious difficulties experienced by the Atchison, Topeka & Santa Fe with a high embankment at Sibley, Mo. This fill comprises the east approach to the Missouri river bridge at this point and is an element in the double-track main line between Chicago and Kansas City, so that slow orders as a consequence of settlement or slides comprised serious obstacles to traffic. Some evidence of water pockets in the embankment were noted shortly after the line was built in 1887, but serious difficulties were not experienced until 1913 and 1914, when it was raised and widened to accommodate double track and provide for a reduction in grade.

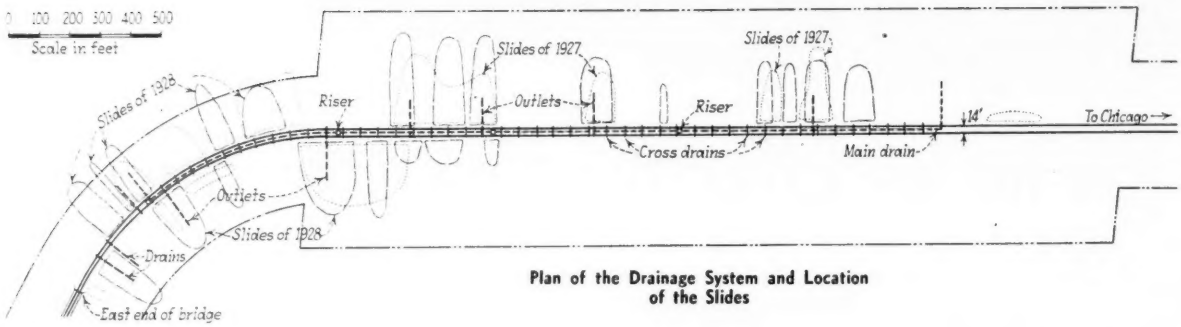
The original bridge and the new superstructure which replaced the old spans in 1915 provide a high-level crossing of the river, with the west approach supported on bluffs that border the south bank, while low land on the north bank gave rise to the need for an elevated approach from the east having a length of about a mile and a maximum height of nearly 60 ft. At first only the base of the embankment was constructed, the material being placed by teams from side borrow to a height of 12 ft. On this a double-deck frame trestle, supported on pile bents with pile cut-offs four feet above the fill, was constructed on an 0.8 per cent grade descending eastward for a distance of 3,900 ft. from the east end of an iron viaduct flanking the east end of the bridge.

This structure carried traffic for a number of years or until a time approaching the end of its service life, when the trestle was filled by train haul from a shovel pit—first to a level about 10 ft. below grade and later to grade, at which time the deck was removed and the track was supported on the new fill. Because of its height and the presence of the decaying timber buried in it, this embankment gave more or less trouble from time to time, and during periods of protracted wet weather was subject to serious slides.

The troubles arose primarily from the formation of water pockets and when preparations were made for widening the embankment for double track and for raising it to reduce the grade to 0.5 per cent against westbound movements, many rock drains were installed in trenches extending down the side slopes of the easterly or lower half of the old embankment. These drains proved thoroughly effective and no serious slides have since occurred in the new embankment constructed over this part of the old fill.

Because of the reduction in grade, the enlarged embankment that was constructed at this time is 9.1 ft. higher than the old fill at the west end and extends to the east a distance of 10,000 ft., involving a maximum lift of 22 ft. above the old grade. Like the main portion of the old embankment, the additional fill required for the new work, 1,750,000 cu. yd., was made by train haul from a shovel cut. It consisted largely of clay and was placed by dumping over the shoulder and spreading.

View of the Roadbed After the Work Was Completed Showing Rock-filled Trenches Over the Drains



Plan of the Drainage System and Location of the Slides

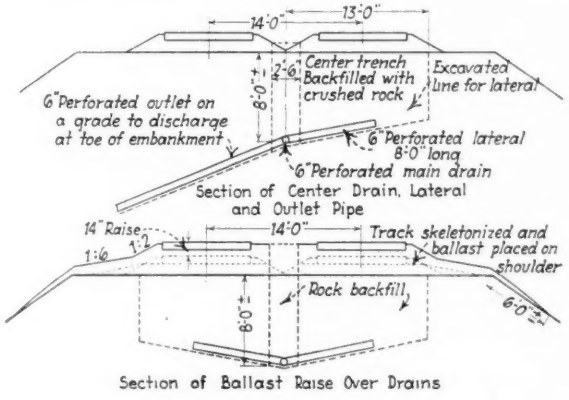
The higher part of the new fill gave trouble from the start. Being placed against the slopes of the old fill, it early showed a tendency to sliding on the cleavage plane between the new and old fills. At one time during construction, a section 100 ft. long broke off at the ends of the ties, settled three feet at the top, and its lower end was found to have forced its way several feet below the original ground surface at the toe of the slope. To meet this situation, a trench 16 ft. wide and extending 8 ft. below the bottom of the slide was excavated along the base of the embankment and back-filled with train-haul material, thus providing a key of solid material to hold back the weight of the fill. This trench was too deep to permit of surface drainage, so a sump was excavated to quicksand at a depth of 12 ft., filled with riprap and broken stone and covered with 2 ft. of earth. From this sump a trench 4 ft. wide and 6 ft. deep was excavated up the slope through the slide and likewise filled with riprap and crushed stone.

As a further safeguard against slides, a berm of earth was placed against each slope of the higher part of the embankment to a level equal to about a third of its height and having a top width of about 30 ft.

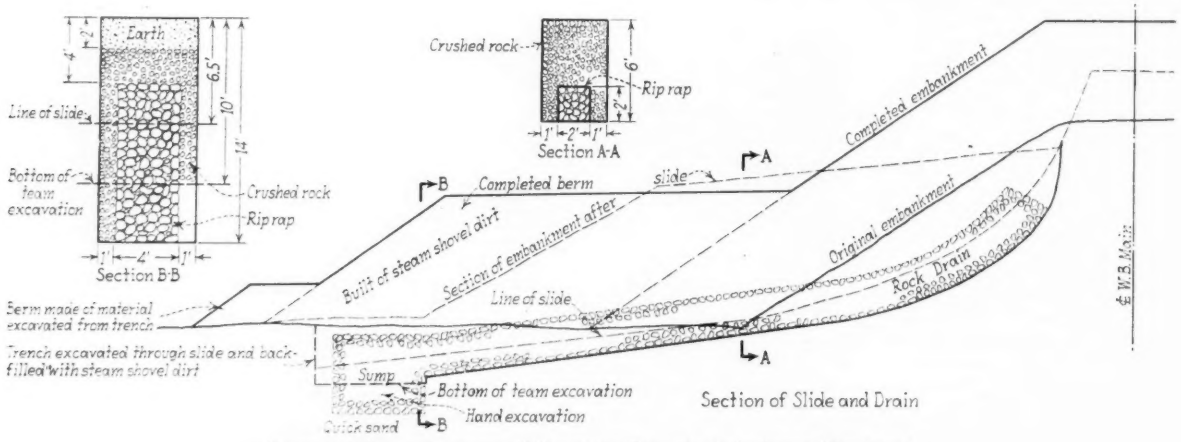
Following the completion of this new work the embankment did not give serious trouble until April, 1927, when a series of slides occurred on the west or higher part of the embankment. These slides, of which there were four in the south slope and eight in the north slope, extended over a track distance of 3,600 ft. Two of them were 350 ft. wide, while two narrower ones pushed down the slope through the berms, developing a length of about 230 ft.

In November of the following year there was a recurrence of this trouble in a more aggravated form, with 8 slides on the south side and 13 on the north side. While most of them were not as wide as those that occurred in 1927, several extended further down the slope and through the berm, two of them breaking from the ends of the ties.

As a study of the situation led to the conclusion that the slides were primarily the result of water pockets in the roadbed, authority was granted in 1929 for a system of subsurface drainage that would effectively release the water from these pockets. In accordance with the plan adopted, a trench 30 in. wide was excavated between tracks to a depth averaging 6 ft. below the roadbed level, with branch trenches extending laterally under both tracks at intervals of 50 ft. In these trenches were laid 8-in. perforated corrugated galvanized iron pipes, the pipes in the lateral trenches being placed on a grade of approximately 20 per cent to insure effective flow to the main drain in the longitudinal trench, which was also given a slope to insure



How the Roadbed Was Drained



Measures Taken to Overcome Sliding at the Time the Embankment Was Raised

drainage to outlets of non-perforated corrugated galvanized iron pipe that were carried down the slope in trenches at intervals of about 500 ft. All trenches in the roadbed were back-filled with crushed stone, which was also placed under the pipes to a depth of 4 to 6 in.

After the drains were installed, the gravel ballast was removed down to the bottoms of the ties and wasted on the shoulders and slopes of the embankment. The tracks were then given a lift of 12-in. on limestone screenings which were used also to dress the track and cover the entire roadbed, as well as a portion of the embankment slopes. Between tracks and on the shoulders, the blanket of screenings has a thickness of about 12 in. and then tapers down over the slopes for a slope distance of about 20 ft., as is shown clearly in one of the photographs. These screenings possess considerable cementing quality and serve as a roof over the roadbed that sheds considerable of the rainfall water.

No trouble of any kind has been noted since the drainage system was installed, and there is every evidence that the roadbed is being effectively drained. The outfall drains discharge considerable water after storms or periods of protracted rainfall, the tracks have remained in good line and surface and there has been no recurrence of the slide conditions.

We are indebted for the above information to G. J. Bell, district engineer, Atchison, Topeka & Santa Fe, Topeka, Kan.

Track Slabs Reduce Cost of Waterproofing

By J. B. HUNLEY

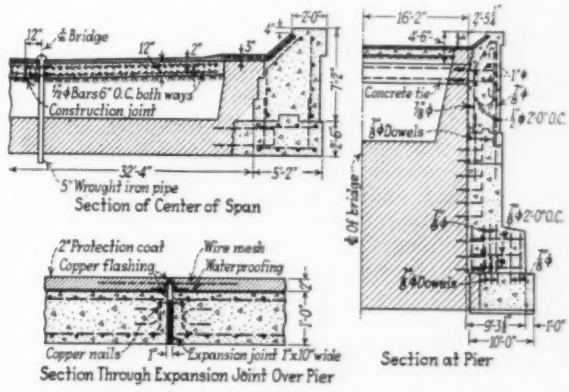
Engineer Bridges and Structures, Cleveland, Cincinnati, Chicago & St. Louis

A COMMON fault of spandrel-filled arches is inadequate drainage. This condition results from a number of causes, chief among which are undersized and improperly located weep holes, a lack of definite drainage channels, and the use of spandrel filling that retains water and supplies it to surfaces through construction joints, mortar joints or honeycombed areas. Water, accompanied by alternate freezing and thawing, is the great enemy of masonry, whether of concrete or stone. Surface water applied by rains to an exposed surface that drains readily is of little consequence compared with a continual supply from a "reservoir" between the spandrel walls of arches or behind retaining walls. The number of cycles of freezing and thawing of masonry in a saturated condition is then a maximum.

The Big Four bridge No. 631 on the St. Louis division is a case in point because the defects in the drainage and their consequences were typical, while the means adopted to correct the conditions encountered suggest a way out of such difficulties that is simpler and less costly than the methods usually employed. This bridge is a double-track structure of two 40-ft. arches with gravity type spandrel walls of mass concrete. The spandrel filling is a clay that is ideally suited to retain moisture and prevent the formation of definite drainage channels to the weep holes.

This drainage condition, or lack of drainage, produced the best possible condition for a freezing and thawing attack by keeping the concrete saturated over areas that were not impervious. Considerable evidence of unsound aggregate was also presented in the disintegration resulting from a combination of freezing and thawing of the saturated surface concrete. In order to make the work reasonably permanent it was patently necessary to remove the cause of disintegration, namely, saturation of the concrete at points of perviousness.

Comparative estimates were made of the cost of various schemes to correct the poor drainage and to strengthen the spandrel walls which showed evidence of pushing out at the top. To have removed the spandrel filling for the purpose of waterproofing the extrados of the arches and the inside faces of the spandrel walls would have required falsework for the support of the tracks and the need for providing more suitable back filling. Furthermore, the circumstances attending such measures would have made it difficult to obtain a satisfactory job of waterproofing, and estimates developed that this method of solving the problem would have cost several thousand dollars more than the cost for the plan adopted.



Details of the Structural Changes Made in the Bridge

This plan had a twofold purpose, (a) to prevent water from reaching the spandrel "reservoir" from which the concrete was kept saturated, and (b) to strengthen the spandrel walls. The first purpose was accomplished by sealing off the top of the spandrel filling from the entrance of any water and was carried out by covering the fill with a slab of reinforced concrete one foot thick, over which waterproofing was applied that extended over the top of the old spandrel walls and was flashed under the coping of the new walls as shown in the drawing. After the waterproofing and its protective coat had been applied, the ballast was replaced and the track restored for service. To insure adequate drainage, the slab was sloped four ways to five-inch wrought iron pipes that were passed through holes drilled in the crown of each arch. This was provided with a suitable drain head and also projected below the soffit of the arches to insure that the seepage would drip clear and not flow down the surface.

The work was done in two longitudinal sections, one half being completed while traffic was confined to the opposite track and vice versa. Especial care was taken to insure that the waterproofing was continuous over the longitudinal joint between the two halves of the concrete slab. A sketch shows how this was done.

The spandrel walls were strengthened by extending the arch rings and piers and building new spandrel walls outside the old ones. This new concrete was attached to the old arch rings with ⅞-in. round dowels on 4-ft. centers, grouted into holes 18 in. deep. Further strengthening of the new spandrel walls was effected by means of reinforced concrete tie beams that aid in holding the two walls together.

Watching the Injury Ratio*

Development of common sense through personal contact, friendliness and understanding found solution to safety problem

By F. J. JEROME
Division Engineer, New York Central, Chicago

WITH few exceptions, all accidents occurring in the maintenance of way department are avoidable, and I look forward confidently to the time when we will be comparing our safety records not on the basis of the number of Interstate Commerce Commission cases we have per year, but on the basis of the number of years we have gone without such a case. Our problem is to avoid accidents before they occur and the only way that this can be done is to develop to the maximum degree the ordinary common sense that is in each of us, through personal contact, friendliness and understanding.

The employees in the maintenance of way departments of our roads outnumber all other employees, and, since it is these employees that are having the accidents, all our efforts must be directed primarily with a view to the development of their common sense. The heaviest burden in this undertaking falls on the foreman, who is in close contact with his men, but the foreman can not and should not be expected to assume this burden unless he has the whole-hearted support of his superior officers.

For several years, the management of the New York Central has sponsored annual safety meetings for maintenance of way foremen, which are held each winter at suitable times and places, depending on the general condition of the work and on the weather. These meetings are presided over by the division engineer and are attended by all track foremen and their assistants or first men. The divisions are divided into districts, possibly three or four, and two meetings are held in each district at some central point, each meeting being attended by foremen from every second gang and assistants from alternate gangs, thus maintaining the gang supervision and causing no interruption to the work. The management gives those attending the meeting full time allowance and pays for their meals while they are away from headquarters.

Conduct of the Meeting

The meetings are opened with a few general remarks from the chairman, which are followed by a longer talk by the supervising safety agent, in which he reviews carefully and in detail the principles of safety work as applied to the maintenance of way department. This talk is followed by an open discussion by the men themselves which takes up the bulk of the time allotted and which, to my mind, is the most valuable and important part of the meeting. Each foreman and assistant present is called upon to stand up and contribute to the discussion. He is asked to outline the steps he has taken in the interests of safety; to discuss any accidents that have taken place in his gang during the past year; to explain the cause and outline the action taken to avoid their recurrence; and to tell what success he feels he has had in instilling the proper spirit in his men and in developing their common sense.

Officers and Foremen in Attendance at a Division Safety Meeting

At the commencement of these annual meetings, about six years ago, only a few of the foremen were competent to stand up and express themselves along these lines, but with experience they have overcome this embarrassment and now there is hardly a man among them who cannot make a convincing talk on safety. There is no doubt that these men realize the extent of the benefits they have derived from a mutual and frank discussion of safety problems.

The engineer maintenance of way attends as many of the meetings on each division as is possible and, not only by his words but by his mere presence, impresses on the foremen his interest in their work and the extreme importance of personal contact and understanding in relation to safety. I believe once a year is sufficiently frequent for these general meetings. The follow-up after the foremen get back to their men is what brings results.

Ten-Minute Safety Talk Each Week

In accordance with instructions issued several years ago, each foreman gives his men a ten-minute talk on safety each Monday morning. This is compulsory and consists usually of the reading and discussion of several of the more important safety rules. This practice was of great value during the early stages of the campaign, as it promoted the habit of thinking "safety" at least once a week, and the men absorbed some of the principal safety rules at definite intervals.

Moreover, I have urged on our foremen that they study each of their men carefully. No two men are constituted alike, and consequently each one requires a different method of approach in getting him to comprehend completely the safety idea. Some of the foremen are putting a great deal of thought into this problem and most of them are studying and talking with their men every day, both individually and collectively, with a view to performing every job safely. This action on

*Abstract of a paper presented before the Twentieth Annual Safety Congress of the National Safety Council at Chicago.

the part of the foremen must be continuous if we are to have no-accident gangs, no-accident subdivisions and no-accident divisions in the maintenance of way department.

No man wants to undergo bodily suffering, nor does he want to cause suffering to anyone else, and, consequently, safety should be the easiest thing in the world to sell as it costs the individual nothing and is something that everybody wants. However, there are a few men who are habitually careless and for them there is no place in the maintenance of way department. In order that the foreman, the supervisor and myself may be able to judge fairly whether a man is careful or habitually careless, we must know our men. The foremen, of course, should know the men intimately, but it is the aim of the six supervisors on my territory and of myself also, to know every one of our men personally. We have made considerable progress and I earnestly believe that when this personal contact is completely established and a full understanding arrived at, we will have no more avoidable injuries. The place for the supervisor and the division engineer is out on the job just as much as their office work will permit, and they should arrange this work so that it will permit them to be out most of the time. Close contacts with the work and the men promote not only safe work, but efficient work.

Procedure in an Injury Case

I receive an immediate report of all accidents that occur on my division and require the supervisor or his assistant to make an investigation on the ground not later than the following day, taking statements from the injured man, his foreman and any witnesses to determine the cause of and responsibility for the accident and how to avoid a recurrence of similar accidents. These statements are sent to me with the supervisor's comments and recommendations as to any further action that should be taken. If an injured man loses time, advice to that effect is received at my office by telephone immediately. I keep in touch with such cases personally and, if necessary, I sometimes talk to the injured man or to the doctor who attended him, with a view to getting the man back to work within the three-day limit, unless it would be injurious to his health, thus avoiding a case reportable to the Interstate Commerce Commission. By taking action promptly and by getting all the facts quickly and, most important, by knowing our men personally, we have been able to save a number of cases that would have been reportable to the commission if no particular attention had been paid to them.

For several years, safety contests based on the number of injury cases reportable to the Interstate Commerce Commission per million man-hours worked, have been conducted on the New York Central Lines among the various system lines as a whole and among the same departments of the various lines. Data are also assembled and distributed on the standing of the various departments by operating divisions. On my territory, however, we have been going even further. At the end of each month a supervisor sends out a statement to his men which shows the safety record of each foreman and which is accompanied by a letter discussing any accidents that have occurred during the past month. In addition, I send out a letter and statement to the supervisors, showing the safety record of each of their territories for the elapsed months of the year, and for the same period of the previous year. This statement is in turn passed on to the foremen. Thus we are, in effect, conducting a contest between gangs and between supervisors, while at the same time, each foreman and each supervisor is also competing with his own record for the same period of the previous year.

I am quoting below the number of accidents reportable to the Interstate Commerce Commission on my division during the last four years and the number per million man-hours worked, not for the purpose of giving this division any particular credit but in support of the methods we have tried and believe in.

Year	*Number Reportable Cases*	*Ratio*
1928	30	6.31
1929	28	7.47
1930	11	3.78
1931 (First 8 months)	1	0.71

We have not yet adopted any system of awards in connection with the contest between gangs and between supervisors' territories, although this is being given consideration. A large number of the foremen feel, however, that the satisfaction that they derive from standing up in the annual foremen's meeting before the other foremen and their superior officers and stating that they have had no accidents for the past year or the past several years, as the case may be, is sufficient reward for what has been accomplished.

A division engineer should have a detailed knowledge of all accidents that have occurred on his territory. If he cannot remember the details, he is having too many of them; the answer being more personal contact and understanding. A division engineer should feel a definite responsibility for every avoidable accident occurring on his division.

Many Types of Doors for Freight Houses

THAT a variety of types of doors may be applied to freight houses and that each imposes its own problems of maintenance and operation is clearly set forth in a report presented before the A.R.E.A. convention at Chicago on March 16, by the Committee on Buildings. This report, which was prepared by a subcommittee headed by J. W. Orrock, engineer of buildings, Canadian Pacific, is presented in abstract below.

The ordinary wood door of built-up construction is usually of white pine or cypress or other species of wood adaptable to exterior use in the climates where it is used. The thickness varies according to the size of the door and, in general, is about 2¼ in. from the average door. Glass panels can be provided if required.

Doors of this type are usually hung on metal hangers bolted to the door frame and supported above by a metal runway, and are manually operated. For easy operation the trolleys should be kept lubricated and the doors and hardware should be painted regularly to keep them from deteriorating. Single sliding doors require considerable wall space between doors.

A mill-type door consists of a metal frame and a laminated wood filler. The metal frame forms the hanger and the wood filler consists of 1¾-in. square tongued and grooved strips. The wood strips are nailed to each other through the tongue and groove, piece by piece, and the strips next to the metal are nailed to the frame. The wood strips are painted before fitting and no nails are exposed. This type of door is exceptionally strong and

rigid, and being hung on a metal frame, there is little or no strain on the wood, and consequently no sagging or pulling apart, such as is experienced with the ordinary wood door. It is supported on overhead metal runways like those for the ordinary wood door.

Corrugated Sheet-Metal Doors

A corrugated sheet-metal door consists of two layers or thicknesses of galvanized corrugated sheet metal with a layer of sheet asbestos between them and reinforced with structural steel frame members. The corrugations on one side of the door are horizontal and on the opposite side vertical; the door can be provided with glass panels if required. This door, while rigid, is more easily damaged than the wood door and requires more maintenance, especially painting, to prevent corrosion. This type is suitable as a fire door and is used extensively for this purpose. It is supported on metal hangers and overhead runways similar to those used with the ordinary wood door.

Tin-clad doors are used generally on interior fire walls and are usually made of three layers of boards, dressed to a total thickness of 13/16-in., with the outside layers vertical and the inner layer horizontal. They are thoroughly fastened together by wrought iron clinch nails not over eight inches apart, extending clear through the door and clinched on the back side, leaving both surfaces of the door smooth, and are then clad in tin, with double-lock joints in the tin covering. They are provided with the necessary hangers, track, fixtures and fusible links, as required by the rules of the fire underwriters. The doors may be either sliding or swinging. This type of door must be well maintained; the wood core is subject to dry rot.

Steel doors consist of heavy pressed-metal sheets fabricated in the shop. The joints are fitted, reinforced, welded and dressed to produce neat connections. The same hardware and track are applied as for the doors already described. While steel is more commonly used for the two types of rolling doors, wood rolling doors are also obtainable, but are not as widely used as the steel type. They are installed and operated in a manner similar to rolling steel doors. Possibly one advantage of the wood over the steel rolling door is that it is not subject to corrosion. However, it would appear that a disadvantage of the wood rolling door may be the possibility of the wood slats shrinking, swelling and warping, due to atmospheric changes.

Rolling Metal Doors

For single or continuous openings divided by posts, rolling metal doors are often used. These doors take up little wall and overhead space, but they cannot be glazed satisfactorily. This type of door consists of a curtain of interlocking steel slats, which are coiled on overhead enclosed barrel or roller, and travel in steel guides mounted at the sides of the openings. Rolling steel doors can be mounted in several ways—directly above the opening either in or outside of the building or, if headroom is limited, in the opening directly under the lintel. The use of the rolling steel door permits a wide range of opening sizes not attainable by the use of some of the other types of doors. Except for small doors, which are manually operated, they require a chain hoist or electrically driven operating device for proper operation. One disadvantage of this type of door is that if the slats are damaged or bent when the door is in the closed position, the opening is put out of service until the door is removed, the necessary repair parts received and the door repaired. Rolling steel doors should be painted regularly to prevent deterioration and all parts properly lubricated and kept in good condition for easy and efficient operation at all times.

At present there are many different varieties of overhead wood doors, all having their advantages. This type of door usually has rails and stiles 1¾ in. thick, with veneer panels ⅜ in. thick. The door is available in a varying number of sections, can be glazed if required, and is equipped with the hardware, tracks, hangers, counterweights, springs, etc., required for operation. Some types slide up and fold overhead, others slide up, turn and roll overhead. Some of the varieties of light-construction overhead doors now being marketed are applicable only to small openings while others can be had for large openings. These doors are very light and easily operated—some manually while others require chain hoists. They are designed primarily for private garages, service stations, etc., but are adaptable for some types of railroad construction. Any particular merits or maintenance requirements in connection with their use on railroads are not determinable at this time.

Other Overhead Doors

Overhead doors also include various heavy types of all-wood construction, mill-type construction, and metal construction. Some of the more common types are bifolding doors, single and double-section turnover doors, sectional overhead doors, etc. The different types of construction correspond to those described in the preceding paragraphs. These types of doors are adaptable to either single openings or partially continuous openings, such as are divided by posts, columns or narrow masonry piers. The bifolding type slides up and folds in two while ascending, single and double-section turnover doors slide up, turn and roll overhead, and the sectional overhead doors operate in a similar manner. All of these types have their advantages, most of which have been previously described. One disadvantage, especially of the single and double-section turnover door and the sectional overhead door, is that when it is in a raised or open position, it occupies considerable space overhead, which in many instances interferes with the overhead electric lighting. Doors of this type can be manually operated for the smaller openings, but, in general, require either chain hoists or electrically-driven operating devices. The maintenance of these doors is about the same as of those previously described.

Vertical-lift doors can be used for any class of opening and can be of types of construction heretofore described. This type of door requires considerable headroom along the face of the wall directly above the openings. These doors are of single, double or multiple sections and of one, two or more speeds. They are operated manually, with chain hoists, or by electrically-driven operating devices. All counterweights and moving parts should be suitably guarded. After installation, these doors must be inspected periodically to see that cables, pulleys, etc., are in proper condition to carry the load and prevent accidents.

Where continuous openings are desired, parallel sliding doors are hung on two lines of overhead tracks, and two continuous slots or grooves are provided in the floor in which the doors are held in place and prevented from moving laterally. Continuous door installations permit the placing of cars along a building without any great care in spotting, for any section of the freight house, etc., can be opened by sliding the house doors opposite the car doors. Where weather-tight enclosures are required, metal strips are sometimes attached to the bottoms of doors sliding in slots or grooves.

Storing Explosives Safely

Rules to be observed for protecting life and property when providing housing for dynamite and allied products

By JACOB BAUER

This Dynamite Magazine on the Northern Pacific Meets All Requirements.

THE use and storage of explosives on railways, as elsewhere, involves a hazard to life and property that can be minimized only by strict adherence to the rules and practices that have been developed by explosives manufacturers and experts. The information given in this article is based on these rules and practices and its use as a guide in the storage and handling of explosives will do much to reduce the attendant danger to life and property.

The solution of the problems involved in the safe and suitable storage of explosives is based on a common-sense technic, coupled with years of observation and experience on the part of explosives manufacturers. The two most important considerations in connection with the storage of explosives are the location and design of the magazine in which they are to be stored. All magazines should be located in compliance with state laws. However, if the laws specify a distance less restrictive than the American table of distances (see accompanying table), or if no state law exists, this table should always be used. The design of the magazine, insofar as the storage of dynamite is concerned, must cover three cardinal considerations: It must be weatherproof, fireproof, and bulletproof. Magazines designed to store black powder must be weatherproof and fireproof.

The problems of the location and design of a magazine raise the following fundamental questions:

1. Where should it be located?
2. What size should it be?
3. What material should be used, and how should it be constructed?

Safe and Suitable Storage

Explosives experts are careful to differentiate between safe storage and suitable storage. Storage, they say, may be safe but absolutely unsuitable, or it may be suitable to protect explosives, but absolutely unsafe. Safe storage may be defined as the storing or keeping of explosives where no injury would be likely to occur to persons or property in the event they exploded. Any other storage would be unsafe. Suitable storage, on the other hand, is not a question of individual opinion, but is based upon the fundamental characteristics of the explosives and has been standardized through years of experience. It may be defined as protection from moisture, the weather, fire, excessive heat, theft, unauthorized persons, and, in the case of commercial high explosives, from being shot into. Any other method of storing or keeping explosives, experts insist, would be unsuitable.

The distances in the American table of distances should be doubled when inhabited buildings, public railways, or public highways are not effectually screened from the magazines. Such protection may be provided either by the natural features of the ground or by an efficient artificial barricade of such height that a straight line drawn from the top of any side wall of the magazine to any part of the inhabited building to be protected or to any point 12 ft. above the center of the railway or highway will pass through the intervening natural or artificial barricade. When the natural features of the ground do not afford the necessary protection against the magazine, an artificial barricade may be built, and it is advisable that it should be located only sufficiently far from the magazine to permit of good ventilation between it and the magazine—say two or three feet.

An artificial barricade may be simply a mound of earth of the necessary height with a minimum thickness of three feet at the top, or it may have the side next to the magazine or both sides and ends faced with timber planking. When building barricades it is important not to use stone, gravel or other material that might provide dangerous missiles if there should be an explosion in the magazine.

Storage in Two or More Magazines

It may sometimes be found impossible to provide the desired storage in one building on the most desirable site in compliance with the American table of distances, or with the state law, as the case may be. In such cases it is common practice to build two or more magazines, to reduce the amount to be stored in each magazine so that each will comply with the table of distances. If more than one magazine is to be built in the same general location, each building containing more than 5,000 lb. (excepting blasting caps or fuse) of explosives and not over 25,000 lb. should be at least 200 ft. away from any other magazine, this distance to be increased 2⅔ ft. for each additional 1,000 lb. over the 25,000 lb. to be stored. For example, if 50,000 lb. is to be stored in each magazine or in any one of the magazines, the distance between magazines should be 267 ft. This distance may be reduced one-half if the magazines are effectually protected from each other by natural or artificial barricades. Blasting or electric blasting caps should not be stored less than 100 ft. from another magazine and, if the quantity of them is large, it may be desirable to conform to the foregoing suggestions.

Another important consideration in connection with the storage of explosives is the manner in which the product is placed in the magazine. Experts insist that boxes of high explosives should be laid flat, top side up, and that black powder should be stored with the kegs standing on their ends with the bungs down, or on their sides with the seams down. Explosives of the same grade and brand should be stored together and in such a man-

ner that the brand and grade are exposed to view. All stocks should be so stored as to be easily counted and checked and so that the oldest stocks can be delivered or used first. Black powder kegs should be thoroughly shaken by hand sufficiently often to prevent caking, but should not be knocked against the floor or against each other.

When magazines need repairing on the inside, all explosives should be removed to a safe distance and protected. If black powder has been stored in the magazine, the floors should be washed with water before repairs are made, and, if the magazine has contained dynamite and

American Table of Distances

Pounds of Explosives	Distance to Inhabited Buildings Barricaded (Feet)	Distance to Public Railway Barricaded (Feet)	Distance to Public Highway Barricaded (Feet)
500	400	240	120
600	430	260	130
700	460	275	140
800	490	295	150
900	510	305	155
1,000	530	320	160
1,500	600	360	180
2,000	650	390	195
3,000	710	425	210
4,000	750	450	225
5,000	780	470	235
10,000	890	535	265
20,000	1,055	635	315
30,000	1,205	725	360
40,000	1,340	805	400
50,000	1,460	875	440
60,000	1,565	940	470
70,000	1,655	995	500
80,000	1,730	1,040	520
90,000	1,790	1,075	540
100,000	1,835	1,100	550

there are indications of nitroglycerine stains on the floor, this portion of the floor should be washed with a solution that will neutralize the nitroglycerine. Before any repairs on the interior of a magazine are undertaken an expert should be consulted. If there is any possibility of causing a spark, fire or explosion when making repairs to the exterior of a magazine, the explosives should be removed to a safe distance from the magazine and properly cared for until repairs are made.

General Rules

In dealing with the problems of locating and designing magazines and placing explosives in them, explosive experts should be consulted in all cases. For general guidance, meanwhile, the following general rules, which are based on years of study, experience and observation, are offered:

Explosives should always be handled carefully.

Place a competent person in charge of the explosives and the magazine in which they are stored. He should keep the magazine keys and be held responsible if safety precautions are not observed.

If artificial light is needed, use only an electric flash light or electric lantern; do not use oil-burning or chemical lamps, lanterns, candles or matches in magazines, or carry matches in, around or near magazines or explosives.

Do not allow unauthorized persons in or near magazines or explosives.

Do not shoot at a magazine.

Do not allow explosives to be exposed to the weather or to become wet. Explosives transported in open vehicles should be protected from the weather by tarpaulins.

Keep magazine doors locked when no one is engaged inside and keep the ground around magazines clear from debris, grass, leaves or trash to prevent fire from reaching them.

Do not store, use or have explosives in or near a residence.

Store explosives so that grades and brands show and so that the oldest brands may be used first.

Do not store explosives in an inhabited building, blacksmith shop, tool box, oil house, boiler house, barn or any place where, in the event of an explosion, loss of life or property damage may result.

Do not store blasting caps or electric blasting caps with or near other explosives, or transport or carry them together, or leave the caps where children or others can handle them.

Do not store primed cartridges in a magazine with other explosives or make primers in a magazine containing other explosives.

Do not use metal bale hooks or other metal tools in handling or opening explosives.

Open powder kegs by removing the side or unscrewing the bung. Do not use a pick or metal instrument.

Use only a wooden wedge or mallet in opening packages of high explosives (dynamite).

Do not open explosive packages in a magazine or within 50 ft. of one. When it is necessary to open a package and remove a portion of the explosive, the package should be kept covered.

Do not allow loose dynamite, powder or blasting supplies to be exposed in any magazine. Keep floors of magazines clean.

Do not keep steel or metal tools, implements, oil, paint, or other inflammable materials in a magazine containing explosives.

Do not use empty high explosives' cases for fire wood or for shipping cases. They should be piled at a suitable place and burned.

On the Northern Pacific

The magazine shown in the accompanying photograph was constructed for the Northern Pacific near Columbus, Mont., by the writer, in such a manner as to meet all requirements of the company's rules and regulations. It is bullet-proof and natural protection on the rear and sides is afforded by the hill, which is composed of sand and sandstone rocks. The door is adapted from an old vault door made of ½-in. steel, while a second line of protection is provided by an inner steel door ¼ in. thick. Other important factors are that the magazine is fire-proof, water-proof and frost-proof. The interior of the magazine is lined with heavy treated timber which is covered with ordinary ½-in. wood flooring.

The magazine can easily be enlarged at any time to hold 5,000 lb. of dynamite. All state licenses are posted inside the magazine in a conspicuous place. Regular inspections are made by the foreman in order to assure safety at all times. The explosives are stored in such a manner that there are air spaces between all stored columns. All grades and brands show well when one enters the magazine. The oldest grade is stored in a position so that it may be used first.

Ditching on the Illinois Terminal Railroad at Peoria, Ill., with a La Plant-Choate Bull-Scoop Rig Mounted on a Model 10 Caterpillar Tractor and Used to Carry Material to One End of the Cut

How Permanent Roadbeds Are Behaving

ONE of the regular assignments to the Committee on Roadway of the A.R.E.A. is to investigate and report on the service rendered by various installations of special track construction. The following is an abstract of the latest of these reports, which was prepared by a subcommittee of which W. G. Brown, engineer maintenance of way of the Florida East Coast, was chairman, and presented at the convention in Chicago on March 15.

The Lehigh Valley's permanent track construction consists of a 4,893.4-ft. double-track section through Musconetcong mountain, in New Jersey, turned over to operation in November, 1928, and built at a cost of $8.165 per linear foot of track laid. To date the annual maintenance cost has been negligible, while line, surface and drainage are entirely satisfactory.

The Michigan Central's Detroit River tunnel tracks are considered a special type of construction applicable only to this particular location. Maintenance expense is reported as not unusual, and has so far consisted simply of tie and rail renewals incident to ordinary track operation.

A report from the Track division of the Board of Transportation, New York City, on its permanent roadway (concreted-in track) indicates the annual maintenance cost as $0.54 per linear foot of track, in comparison with an estimated annual cost of $0.83 for the ordinary ballasted type. This permanent installation has been in service about fifteen years, requiring nothing but rail renewals to date.

The Northern Pacific's Point Defiance line's permanent roadbed construction was built for experimental purposes, and as the installations were small, it is not thought that original cost figures would be a criterion for similar construction on a larger scale. Maintenance costs have been disappointing and considerably above those on an adjacent track with gravel ballast. The committee was advised that maintenance, interest and depreciation charges demonstrated that this type of construction is uneconomical for the traffic density carried.

The permanent track section constructed by the Chicago Junction Railway in 1911, was replaced by ordinary ballasted track in 1928. The committee was advised that the permanent construction gave good service until tie renewals were necessary, at which time it became very difficult to maintain good line and surface and exceedingly expensive to replace ties in kind.

Long Island Installations

Installations of concrete slabs in the top of the subgrade were made on the Long Island Railroad at Woodside, Jamaica, Bay Ridge, Long Island City, and across Juniper swamp, on the New York Connecting Railroad. The Jamaica installation, about 73,000 sq. ft., was made in 1912 and 1913 in connection with improvement work at most of the turnouts and slips. Slabs were built of a 1-3-6 mix of portland cement, sand and gravel on a 21-ft. embankment of sand and gravel. Approximately 1,300 daily train movements, including both passenger and freight, pass over this section.

The Woodside installation of 1914 was similarly constructed. The slabs there were placed under tracks located on high fills and have rendered satisfactory service and held track repairs to a minimum. The object of this installation was the study of the performance of such slabs under the conditions existing over a fill, and have been useful for the purpose of research, but can hardly be considered necessary at these particular points, as the fill consists of good material which drains readily. The installations at Bay Ridge and Long Island City, constructed in 1916 and 1924-1925, respectively, consist of slabs placed at the heels of four float bridges over an underlying support of old cribbing and riprap with a silt fill, and handle heavy traffic over switches to and from the float bridges.

The Pere Marquette Roadbed

The first installation of the Pere Marquette's test sections of concrete roadbed at Beech, Mich., was placed in operation December 19, 1926, and has been in service nearly five years.* It has been found that the amount of rail batter is more noticeable than on ordinary track, due to the rigid support, from which the rail is separated by only a ⅛-in. layer of pressed-wood fibre. Enough batter had developed on certain joints to make it desirable that riding quality be improved, and in April, 1931, 40 joints out of a total of 68 were built up by the oxy-acetylene process.

The second installation, placed in operation September 20, 1929, remains in the same condition as when built, except that slight surface spalling has occurred at three joints. No cracks have appeared, no appreciable settlement has taken place and no abnormal batter is so far apparent. The method of seating and attaching the rail is entirely satisfactory. Line and surface are unchanged and the track rides very smoothly. The slight feeling of rigidity experienced in riding over the old section is entirely lacking. The use of a ⅞-in. board between the rail and the concrete in the new design has been sufficient to overcome this feature, and yet permits so little deflection in the rail that rail wave is almost eliminated.

The cost of maintaining the Pere Marquette's concrete roadbed at Beech, Mich., during the year from August 1, 1930, to July 31, 1931, is reported to have been as follows:

First Installation:		
Labor tightening bolts, taking up expansion and replacing clips and broken bolts		$ 35.74
Restoring battered rail ends, 41 at $1.86		76.26
		$112.00
New Installation:		
Tightening bolts, 15 hours at $0.45		$ 6.75
This section is 390 ft. long. At this rate, maintenance on one quarter mile would be $22.85.		
Ordinary Roadbed:		
On the nearby one-quarter-mile section of ordinary track on which comparison has been made heretofore, the cost of maintenance was as follows:		
Labor		
Lining and surfacing	$ 40.58	
Making grass line	15.40	
Renewing ties	25.33	
Tightening bolts and tapping down spikes	14.62	$ 95.93
Material		
63 ties at $1.94	122.22	
Spikes	2.20	124.42
		$220.35

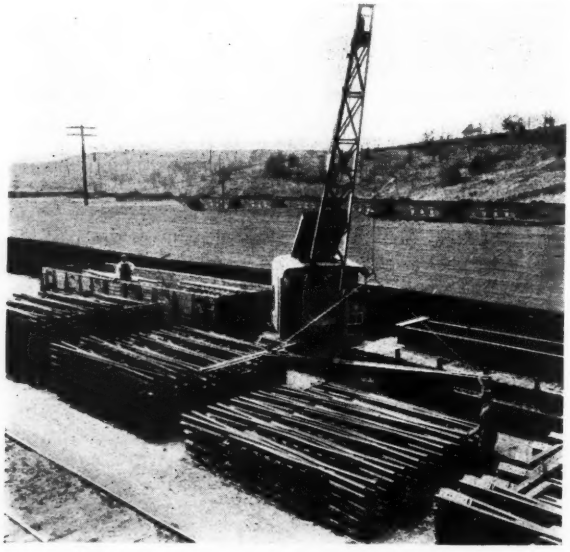
Juniper Swamp installation on the New York Connecting railroad, built in 1917, gives perhaps the best example of the necessity for slab construction under track. This swamp is an old peat bog about 2,000 ft. long and 70 ft. deep in spots, filled with dirt and graded

*For a detailed description see *Railway Engineering and Maintenance* for January, 1927, page 5.

off across the bog for track support. Two spots through this territory were so wet that it was found necessary to build two seven-inch reinforced concrete slabs, one 100 ft. by 13 ft., and another 150 ft. by 13 ft., with approximately 15 in. of cinder ballast on top. No difficulty has been experienced in maintaining tracks in fair condition over these slabs, and regular speed is made, while on either approach to the slabs it was found more difficult to maintain good line and surface.

Engineering Forces Handle Roadway Stores

DURING the last three years the Norfolk & Western has operated a central supply yard for maintenance of way materials, which, contrary to the usual policy, is under the sole direction of the engineering department. This yard, located at Roanoke, Va., was established to permit the concentration of the storing and handling of stocks which had previously been scattered at 23 locations on 7 divisions, and marked savings have been



Dipping Frogs in Oil at the Roanoke Supply Yard

accomplished as a result of this change. At the same time the stock balance has been reduced from $8,572,000 to $2,833,000.

The new system also promotes economy and efficiency in the salvaging and reclassification of material released from the track, and in the shipment of new material for routine track maintenance and rail renewals. When material is taken out of the track during rail renewals, it is classified on the ground as between scrap and relayer material. The scrap goes directly to dealers, while the relayer material, which includes any track fastenings, frogs, switches, guard rails, rail joints, etc., considered fit for further use, is shipped to the supply yard at Roanoke. Here each piece of material is inspected for soundness, and the items which pass the examination are returned to stock for use in filling future requisitions in regular maintenance work.

In the other direction, efficiency and economy are achieved by the close co-ordination of the roadmaster's needs with the central source of supply. When the roadmaster needs rails and track fastenings for emergency maintenance, he orders this material on a requisition blank provided for that purpose. This order is approved by the superintendent of the division and also by the general superintendent. It is then forwarded to the central supply yard. To insure that the roadmaster gets what he actually needs, the order is checked against the track plans and material specifications of his particular district. The material is also assembled for shipment. For instance, heel blocks for switches are not shipped to him in parts, but completely assembled with a bent angle bar, pipe nipple, four nuts and bolts, four bevelled washers and four spring washers.

One of the greatest advantages of the new system is its adaptability to the requirements of the annual rail renewal programs. During the rail-shipping season, the manufacturers advise the officer in charge in advance when each shipment of rail is to be made and its destination, and he immediately instructs the various agents on the line as to the disposition that is to be made of the cars when they arrive. The supply yard then loads into cars the required number of frogs, switches, joints, bolts and spikes, and other kinds of track material, to make the renewal as provided in the program. The supply-yard shipment is loaded in such a manner that any material can be unloaded from the cars without disturbing the other contents and is timed to arrive for distribution with the rail, which is shipped direct to save rehandling.

Daily Reports of Materials Applied

When material is shipped from the central yard, copies of a shipping notice are sent to all concerned, and the material is transferred immediately from the central yard-stock records to the division-stock records and remains thereafter under the supervision of the division superintendent until used. Daily reports of material applied and released are sent daily to the division superintendent, who prepares monthly statements of the material used and released. These are sent to the roadway and bridge material section of the engineering department, where the prices are applied, extensions made and final statements prepared for the accounting department. The price used for new material is the system average actual cost. Material released is salvaged at approximately 50 per cent of the cost of new material, while the scrap is salvaged at the current market price. Any relayer material from the central yard is issued at the same figure at which it was released from use.

No store expense is added to new rail shipped direct to the divisions and none is added to the price of material issued through the central yard. The store expense, however, is spread against the various primary accounts to which the material from the central yard was actually charged. New material returned to stock from a division is credited to that division at the price at which it was originally charged. No material is charged to the various primary accounts until it has been placed in service.

The operation of the yard has been very economical. During 1931, the cost amounted to one per cent of the total value of the material disbursed from it. To prevent the accumulation of materials on the line, those in charge of the yard make a special effort to have the various supervisors clean up and ship any surplus material on hand into the yard twice each year. This is generally done just prior to the roadway and bridge-material inventories.

The roadway material yard was established and operates under the jurisdiction of W. P. Wiltsee, chief engineer, and is under the direct supervision of J. R. Sisler, roadway and bridge-material supervisor.

Putting Collars on Track Chisels

AN ingenious though very simple expedient is employed on the Louisville & Nashville for decreasing the hazard involved in the use of a track chisel. A piece of discarded air hose about 2¼ in. long is forced down over the head of the chisel until only about ¼ in. projects above the striking face of the head. This collar of pliable material which surrounds the head affords considerable

A Track Chisel with a Protected Head

protection from flying particles that have always been a menace to track men. It is not to be understood, however, that this added protection is deemed sufficient to warrant the discarding of goggles by men using chisels.

We are indebted for this information to J. R. Watt, engineer maintenance of way, and T. E. Owen, editor of the L. & N. Employees Magazine.

Producers' Report on Production and Stocks of Crossties

CROSSTIES now available in the stocks of the railways and tie producers are sufficient to meet the present rate of application but are not to be had in the quantities necessary for normal requirements. This is the consensus of reports presented at the convention of the National Association of Railroad Tie Producers at Memphis, Tenn., on May 17.

The production of ties in 1931 was at a low ebb—estimated in the northeastern and southeastern areas at 25 to 30 per cent of the production in 1929. In the north-central territory operations were more spotty, ranging from as high as 80 to 85 per cent in some sections to 25 to 50 per cent in others.

Producers' stocks have decreased until they are now only 25 per cent of normal in the south central territory, and 40 to 50 per cent of the usual supplies in the southeastern territory. This is also true of ties awaiting treatment at commercial plants—the stocks generally being too small to permit of continued operation for any length of time. Thus, in the southeastern district, with plants operating only at 30 to 40 per cent of capacity, the stocks of ties awaiting treatment average about 40 per cent of normal. The stocks of treated ties, on the other hand, are in some cases above normal, especially in the northeastern and Pacific coast areas.

In general, railroad stocks, railroad purchases, producers' stocks and production activities have been drastically curtailed to meet the conditions of a prolonged decline in tie renewals. Purchases in the south central states in 1931 were said to be less than in 1921. On the Pacific coast they ranged from 15 to 20 per cent of those in 1929. In the northeastern states, purchases were confined largely to right-of-way production, thereby affecting a sharp decrease in off-line buying. Shipments in the south central area were off 75 per cent from those in 1929, while in the southeastern section they declined 70 per cent.

Each of those reporting discussed the situation that would confront the producers and the railways in the event of a greatly expanded program of crosstie renewals. The producers, it was reported, have gone to great length to keep their organizations intact, giving part time employment to as many men as possible, especially in the hewn-tie areas. This is not as readily accomplished under mill operation, and especially on the Pacific coast, where tie production is largely a mill operation, shut downs have been frequent.

On the whole, however, tie production could be stepped up quickly in case of an upturn in demand, so that ties could be supplied in appreciably larger quantities than have been produced in the last two years. But a sharp increase in orders would undoubtedly bring about a marked shortage.

Non-Compliance with Rules Caused This Wreck

THE FAILURE of an experienced track foreman to protect his motor car while on the main line, according to a report of the Bureau of Safety of the Interstate Commerce Commission, was the cause of an accident on the Texas & Pacific on August 10, 1931, wherein a section motor car was struck by a passenger train, resulting in the death of the foreman and three trackmen and the injury of another. The following information is abstracted from the bureau's report.

The accident occurred on a single track line about 4,751 feet west of Wickett, Tex., at 10:05 a. m. on a cloudy and somewhat misty day. The motor car was moving east at a speed of about 15 miles per hour when struck by an eastbound passenger train which was about six hours late. Both the locomotive fireman and engineman testified that they were aware of the presence of the motor car on the track for some time prior to the accident but that they supposed it would be removed in time. The engineman stated that when the train reached a point within 500 or 600 ft. of the car he sounded the whistle and applied the brakes in emergency.

According to the only surviving member of the section force, the entire crew was absorbed in watching for loose bolts and was paying no attention to the signals or possible trains. He looked back and saw the train when it was about 80 ft. away, and leaped immediately. He testified that he heard no whistle signal but that, if any of the crew had been watching, the train could have been seen when three miles away. The general roadmaster stated that the track foreman involved had been in the service of the company for 18 or 19 years, and that he had not been on duty, other than the regular hours, during the last few days prior to the accident.

In its conclusions the report stated that the "accident was caused by the operation of a motor car on the main track without protection, for which the track foreman was responsible."

FREIGHT TRAFFIC IN MARCH—Freight traffic moved by the Class I railroads in March amounted to 23,579,783,000 net ton-miles. Compared with March, 1931, this was a reduction of 6,380,877,000 net ton-miles, or 21.3 per cent.

What's the Answer?

Have you a question you would like to have someone answer?

Can you answer any of the questions listed in the box?

To Be Answered in August

1. What is the advantage, if any, in applying oil to the outside of angle bars in track? What kind of oil is most suitable? How should it be applied? When should it be done?

2. What are the relative advantages of reciprocating and centrifugal pumps for deep-well pumping? What are the limitations, if any, of each type?

3. Does track become center-bound more quickly on curves than on tangents? Why? How can the trouble be corrected or minimized?

4. Is it permissible to install anti-creepers on open-deck trestles or steel bridges? If so, should there be any limitation on the length of the span or bridge on which they are applied? What is the most practicable method of holding the ties to which the anchors are applied?

5. When lining track, should a foreman face the sun or have it at his back? Why?

6. What are the relative advantages of wood sheathing and concrete or gypsum slabs for enginehouse roofs?

7. When laying rail, should slack ties be shimmed or tamped to a bearing for the rail? Why? If the latter, should this be done by the rail gang, the section gang or some gang specially organized for this purpose?

8. When necessary to extend the footing of an old pier or abutment, what precautions should be taken in doing the work?

Renewing Switches

How many man-hours are required for the renewal of a main-line turnout? For one in a yard or siding? What effect, if any, does the weight of the rail, the number of the turnout or the character of the ballast have ?

Organization a Requisite for Economy

By J. J. DESMOND

Division Engineer, Illinois Central, Chicago

In congested areas, it is economical to make a complete assembly of turnouts and slip switches outside of the track and then shift or lift them into place. Since most turnouts are renewed under traffic, however, it is important that the force engaged in this work be properly organized and supervised to insure a low man-hour cost; otherwise a great waste of labor is certain to result.

With a well-organized gang, approximately 120 man-hours will be required for the renewal of a No. 10 turnout, distributed as follows: Renewing the rail and installing the frog, guard rail and points, 64 hours; skeletonizing the track, 12 hours; removing old ties and inserting new ties, 32 hours; surfacing, lining, adjusting and dressing, 12 hours.

These figures will vary somewhat for different locations and with the degree of experience of the gang. The cost for renewing a turnout in a yard or siding will also fluctuate widely, depending on the traffic interruptions. In general, the weight of rail exerts only a slight influence on the cost, while rock or cementing ballast may increase the cost as much as 25 per cent. No definite statement can be made as to the effect of the number of the turnout, except to say that the cost varies almost directly with the length of the switch-tie base.

Circumstances May Cause Wide Variation

By Engineer Maintenance of Way

It may be expected that the man-hours will vary widely in different locations as a result of the different circumstances under which the work is done. Lengths of leads and weights of materials must be considered, but there are other factors which have an important influence on the time consumed, some of which are: (1) The amount of preparation before actual installation is started, such as the cutting and drilling of the rails and the bending or other fashioning of the stock rails; (2) the condition of the switch ties; (3) a possible change in the weight of the rail through the turnout; (4) replacement with a turnout of a different number; (5) the distance of the work from the gang headquarters; (6) the relative expertness of the labor used; i. e., as between a gang which specializes on switch work and one which does only occasional jobs of renewal; and (7) the density of the traffic. The character of the ballast will have an important influence only if the switch ties must be shifted.

In the writer's opinion, based on long experience, the renewal of a No. 9 main-line turnout with 100-lb. rail will require an average of 130 man-hours. This is on the assumption that the cutting and drilling of the rails is done by hand at the site of the work. Furthermore, it is to be kept in mind that this represents a fair performance, and that each job presents its own set of conditions. It is offered, therefore, only as a starting point from which the time required for other turnouts of different lengths and character can be estimated, in the absence of more definite data.

Careful Preparation Reduces Time

By J. PADGETT

Section Foreman, Missouri Pacific, Hargrave, Kan.

Careful preparation will reduce the time of actual installation. If the rails are cut and the material is properly laid out, a gang of 16 men, including 2 flagmen, will renew an average main-line turnout in kind with an expenditure of 48 man-hours, neglecting traffic detentions. On the same basis, only 40 man-hours are required for the renewal of a turnout in a yard or siding. In this case the flagmen are not necessary, so that these men can be used productively.

If the gang is of the proper size for the work, the weight of rail does not affect the time of renewal, since the rail is more easily handled than the frog. If the renewal is to be made with a turnout of another number, more time will be required, especially if the new lead is longer than the old one. The type of ballast has no effect, except in those instances where the switch ties must be spaced, the heavier materials, such as stone or slag, requiring more time than chatts, gravel, cinders or other lighter and finer material.

Work Equipment Reduces Man-Hours

By G. D. MAYOR

Assistant Cost Engineer, Chesapeake & Ohio, Huntington, W. Va.

For the purpose of this discussion, it will be assumed that a No. 10 turnout laid with 130-lb. PS rail is to be renewed with 130-lb. RE rail, and that both are fully tie plated. The new tie plates are to be held down with lag screws, which are not used in the present installation. The switch ties are in good condition so that adzing or spacing will not be necessary. The adjoining rail is already laid, so that cutting for closure is not required.

For best results the gang should be equipped with a rail crane, a 4-tool air compressor, 2 pneumatic wrenches, 2 spike drives and 1 rail drill. Under these conditions, which are taken from an actual case, 74.3 man-hours will be required to complete the renewal, this being made up of the following items:

	Man-Hours
Installing switch complete	32
Adjusting points and circuit controller	4
Renewing frog	6.5
Installing two guard rails with clamps	9
Installing running rails, turnout rails and stock rail	18.2
Applying rail anchors	0.6
Applying lag screws (subsequent operation)	0.8
Unloading and loading material	3.2
Total	74.3

These figures represent the average cost for the actual installation. To these must be added other charges which cannot be fairly averaged. The latter include the time of making ready, of moving the gang to the next job, the traffic detentions and other similar charges. In this instance the switch gang was composed of 1 foreman, 15 trackmen and 1 cook.

In general, the character of the ballast does not influence the cost unless the ties must be spaced, but where this is necessary, it cannot fairly be included in the cost of renewing the turnout. The weight of the rail will not affect the cost if a rail crane is employed. On the other hand, the number of the turnout does affect the cost because of the difference in the length of the lead, while there will be a slight variation in the cost of placing the frog, this being in direct ratio to its length.

Because of the range of working conditions to be met, the cost of renewing a turnout in a yard or a siding varies within such wide limits that a standard of cost cannot be set up for this work. Where the conditions approximate those on the main line, the cost should be substantially the same. This is almost never the case, however.

Depends on Density of Traffic

By W. R. GARRETT

Yard Foreman, Chicago, Burlington & Quincy, Pacific Junction, Ia.

The number of man-hours required in the renewal of a turnout depends almost directly on the density of traffic and the spacing of trains, and is influenced somewhat by the season of the year. On multiple tracks, if the traffic is diverted the time can be reduced to a minimum, but even with this advantage the time will be increased if the ties must be renewed.

I have completed the renewal of two turnouts in 8 hours with a rail crane and 50 men, replacing 90-lb. rail with 110-lb. and loading all of the released material, including the old ties. To do this, however, it is necessary to have all material distributed and marked in advance, so that there will be no time lost in hunting for misplaced parts. There is little difference in the time required for renewing turnouts in yards and sidings, except for traffic detentions, unless conditions are such that the material cannot be distributed adjacent to the work. The type of ballast is a minor factor, unless the ties must be shifted.

Insulating Roofs

To what extent is it practicable to insulate the roofs of railway buildings? How can this be done to best advantage ?

Has Made Numerous Applications

By J. W. ORROCK

Engineer of Buildings, Canadian Pacific, Montreal, Que.

In general, the extent to which it is practicable to apply insulation to the roofs of railway buildings will depend on the location and importance of the structures. We have applied insulation over the ceiling under the roofs of some of our buildings with satisfactory results. In these cases the ceiling consisted of a concrete slab with one ply of reinforced building paper on top, mopped with asphalt on both sides and covered with insulating board one inch thick. This form of insulation has been used primarily to reduce leakage of heat to the attic space and prevent the melting of snow and the formation of ice ridges at the overhangs and eaves of the buildings.

In some buildings we have applied the insulating board to the underside of the roof rafters. In other cases the insulation has been applied on top of the roof and the finished roofing was applied over this.

Placing on Top of the Roof Is Cheapest

By F. R. JUDD

Engineer of Buildings, Illinois Central, Chicago

In general, flat roofs are more in need of insulation than pitched roofs because of the attic space below the latter. For the former, good practice consists in placing one or two layers of rigid insulating board over the sheathing or slab, depending on the degree of insulation desired. Single-layer insulation ranges from ½ in. to 1 in. in thickness, while double-layer insulation

is obtained by using two layers of ½-in board. A double-layer is more effective as it permits the breaking of joints. The application of insulation on top is the cheapest since no scaffolding is required and no special members are needed to support the insulation.

We have used insulation on the roofs of passenger and freight stations, office buildings, express buildings, etc., to provide against the penetration of heat during the summer and to prevent heat losses from the buildings in winter. It is always good practice to insulate the roofs of wash and locker buildings which house steam-consuming units. In such buildings the humidity is generally high and the insulation is needed also to prevent condensation when the moisture-laden air strikes the roof.

Reduces Heat Losses

By E. H. WELLS, JR.
Transportation and Government Department, Johns-Manville Sales Corporation, New York

These questions should be considered from the standpoint of the questions which normally arise when the insulation of a roof is contemplated. The first of these is the reduction in heat losses. Roof insulation can usually be justified on the basis of the reduction in heat losses, and the consequent saving in fuel. To be economical, however, the savings which result should be sufficient to equal the cost of the installation within a period of two or three years. It is evident, therefore, that the character of the structure, the purpose for which it is used, the temperature that is desired inside, the outside temperatures and other factors must be considered before an intelligent recommendation for roof insulation can be made.

If a large area of the side walls and roof is glass, the savings which can be accomplished by insulating the remainder of the roof is very slight. On the other hand, if all or a large part of the roof area can be insulated, a large saving in heat losses can be accomplished.

The next important matter for consideration is that of condensation. In industrial and railway buildings it is often important to prevent condensation from forming on the underside of the roof where the humidity is high inside the building and the outside temperature is low. Condensation may cause corrosion of the steel frame or decay in timbers, while the material or other contents of the building may be damaged by the dripping condensate. For such conditions it is important that the temperature of the inside of the roof shall not fall below the dew point of the atmosphere, and this can be accomplished only by the installation of a sufficient thickness of insulating material. While the factor of heat losses should not be ignored, the design of the roof should be based on the ability to maintain a dry under surface.

These are the two primary considerations which affect the decision to insulate a roof. The application may be accomplished in several ways. The type that normally would be used on railway buildings with built-up roofs is what is termed the rigid type. This is a high-grade insulating board, cut to convenient size, and cemented to the roof deck in the proper number of layers to provide the required amount of insulation. The roofing is then applied in the same manner as if no insulation had been used. Gypsum and cork slabs are more generally used on factory buildings where the prevention of condensation is of the most urgent importance, but because of their cost, I do not believe they would be considered for railway buildings.

Another consideration which is often important is the comfort of the employees occupying the building. Roof insulation is often necessary to provide a degree of comfort to the workers, when it cannot be justified on a dollars-and-cents basis in the saving of fuel or added life of the roof as a result of eliminating condensation.

Adzing Ties

When adzing ties by hand for new rail, should the cutting be done with or across the grain? Why ?

Should Be Done with the Grain

By N. M. GAMBLE
Supervisor, Wabash, Peru, Ind.

Ties should be adzed with the grain. If done in this manner, a smoother job results, while the grain of the wood is sealed. When the cutting is done across the grain, the fibres are ruptured and the surface of the wood is frayed. This shortens the life of the ties, since it provides a channel for the entrance of water into the body of the wood, thus providing conditions favorable to decay.

Ties Often Split When Cut with the Grain

By JOHN BEDNARZ
Section Foreman, Great Northern, Rugby, N. D.

In my opinion all ties adzed by hand should be cut across the grain, since there is a marked tendency for the adze to follow any irregularities in the grain when the cutting is done with the grain. When this happens, the adzing does not give a uniform bearing, while the life of the tie is definitely shortened. To do a good job of cutting across the grain, the adze must be kept sharp, otherwise the surface cannot be made smooth, but will have a frayed appearance.

Gets a More Even Surface with the Grain

By J. PADGETT
Section Foreman, Missouri Pacific, Hargrave, Kan.

When adzing ties by hand, the cutting should be done with the grain as this will minimize the probability of damage to the tie from splitting, which occurs so frequently when the cutting is done across the grain. By this method a surface is obtained that is much neater and more even than if the cut is made across the grain, since the wood does not fray or splinter and seldom splits. When adzing across the grain, the workmen are exposed to a greater hazard of personal injury, unless they keep well apart.

Adzing Across the Grain Is Safer

By L. G. BYRD
Bridge and Building Supervisor, Missouri Pacific, Wynne, Ark.

The foot adze is one of the most hazardous tools used by maintenance of way employees. For this reason its use should be surrounded by every precaution to prevent its glancing and striking the man using it or other employees who may be nearby. Furthermore, the adzing is done to obtain a full and uniform bearing under the tie plate or base of rail, without which good track conditions cannot be assured.

Ties to be adzed by hand should be scored to the depth necessary to obtain a full-face surface, and the adzing should be done across the grain, to insure a bearing as

smooth as is practicable. If they are adzed with the grain, a flat bearing is seldom obtained, since the tendency is to cut deeper at the center than at the ends of the adzed area, in addition to which the adze tends to follow any distortion of the grain of the tough woods from which ties are made, while splinters often cause the adze to glance and cause personal injuries.

Favors Cutting with the Grain

By District Roadmaster

It is my opinion, based on experience with both methods, that the adzing of ties should be done with the grain instead of across it. If done across the grain, large slivers may be torn loose or pieces of wood broken from the tie, while this method sometimes causes splitting. Any one of these results will damage the tie.

Water Hammer

What is water hammer? How is it caused and what are its effects? What means can be employed to eliminate or minimize these effects ?

Caused by Sudden Stoppage of Flow

By J. H. DAVIDSON

Water Engineer, Missouri-Kansas-Texas, Parsons, Kan.

When water flowing through a pipe is suddenly checked or stopped by the closing of a valve, a force is produced which is in excess of the static pressure in the pipe. This force is called water hammer. In small pipes it is often possible to close valves almost instantaneously, in which event water hammer may produce pressures as great as 100 lb. per sq. in. Even in larger pipes where more time is required for closing the valves, the excess pressure which results from water hammer may amount to 50 per cent of the static pressure.

These sudden increases in pressure, together with the impact which they create, may burst the pipe, blow out joints or damage valves and fittings. In water-distribution systems in buildings, the noise of the water hammer is frequently the cause of considerable annoyance.

Considerable experimental work has been done to determine the facts with respect to water hammer. Among the data developed, it has been found that the velocity of flow, the volume of water involved, the length and diameter of the pipe, the elasticity of the metal in the pipe and the time required to close the valve or gate, all affect the intensity of the effect of the water hammer. For any given velocity of flow, the maximum water hammer will be caused by the practically instantaneous closing of a valve. The greater this velocity, the greater will be the force exerted by the water hammer.

For these reasons, water hammer can be eliminated or minimized by designing pipe lines to keep the velocity of flow to a minimum and to prevent the too sudden closing of valves. Again, the installation of surge tanks, air chambers and slow-closing valves on lines where the velocity of flow is necessarily high, will minimize the damage from water hammer. Cross-connections to avoid dead ends in pipe lines will also be helpful.

It has been found that the manner of closing valves in large-diameter pipes has a considerable effect on water hammer. If the valve is closed rapidly at first and more slowly toward the end of the movement, the water hammer will produce a lower maximum pressure than if it is closed at a uniform rate.

Slow-Closing Valves Give Best Results

By Engineer of Water Service

Water hammer is the effect of the impact which results from a sudden stopping of the flow of water in a pipe line. As the water flows through the pipe, it has a certain amount of potential energy, the magnitude of which depends on the volume of water and the velocity of flow. If the flow is stopped suddenly, the potential energy is changed into kinetic energy and transformed into work, and this is applied in an effort to compress the water, to stretch the pipe and to increase its diameter. Since water is incompressible, the change of the potential energy into work is nearly instantaneous, so that it is applied to the pipe in the form of a blow.

In the effort to compress the liquid, the pressure is increased far above the static pressure of the water, and as this pressure is transmitted equally in all directions, it may burst the pipe, blow out the joints or damage the valves and other fittings. Sharp bends in a pipe line tend to retard the pressure wave, with the result that the line may be torn apart unless the bends are braced properly. Dead ends should be avoided by means of cross connections, since the effect of water hammer here is the same as at a bend.

Elimination of the effects of water hammer can be accomplished only by eliminating the water hammer itself. The only method of doing this is to reduce the velocity of the water gradually through the use of slow-closing valves. These effects can be minimized, however, by the installation of air chambers, relief valves or surge tanks. Air chambers, if of ample size and properly located, will absorb a large part of the impact. They have the objection that it is difficult to keep them supplied with air. The effect of relief valves and surge tanks is the same, but the latter may be expensive to install. Slow-closing valves should be of the type which closes rapidly at the start and then completes the movement slowly, since it has been found by experience that this will practically eliminate the possibility of water hammer.

Repairing Bridge Seats

Where bridge shoes are cutting into concrete or old stone bridge seats or other forms of failure occur in bridge seats on piers and abutments that are otherwise sound, what methods should be employed to overcome the trouble? How should the work be done ?

Remedy Depends on Cause

By JOHN L. VOGEL

Bridge Engineer, Delaware, Lackawanna & Western, Hoboken, N. J.

There are several reasons why bridge shoes cut into concrete bridge seats. From my own experience with this trouble, I am led to believe that the most frequent reason is improper design or workmanship on the bridge seats. Most of the cases I have found have been on bridge seats that were constructed a number of years ago, when little attention was given to the matter of drainage. At the same time the construction forces did not recognize the importance of obtaining an even bearing surface or of avoiding laitance.

When water is allowed to collect under the shoe and to this is added an uneven bearing surface, the concrete is worn away by the churning of the shoe. I have also found in a very few cases that the bridge shoes were

inadequate in size for the load, which resulted in excessive compressive stresses in the bearing area of the concrete. Another cause which has come to my attention has been the erection of the steel and the application of full loading before the concrete was of the proper age and fully hardened.

When trouble of this character occurs on stone bridge seats, it is usually found that the stone which receives the bearing is too soft or otherwise poor in quality. I have never found it to occur where a good grade of granite or other hard stone was used.

My method of correcting existing conditions of this character is, first, to determine whether the shoes are of the proper size and whether the compressive strains in the concrete are within the allowable working strains. If no change is found necessary in the pedestals and if the shoes have cut into the concrete only slightly, the concrete is removed for several inches around the edge of the shoe and a suitable thickness of sheet lead is installed under each of the shoes involved. It is also generally necessary to provide drainage for the bridge seat. This is accomplished by cutting drainage grooves back of and along the sides of the shoes, extending them to an outlet at the face of the bridge seat.

If the cutting has been allowed to continue for some time and shims have been inserted at intervals to keep the bridge at proper elevation, it is generally necessary to provide an entirely new bridge seat for the shoe. This is particularly true where the depth of the cutting is one inch or more. The best method of correcting the trouble in such cases is to cut out enough of the original concrete and replace it with a reinforced-concrete slab bridge seat of the proper thickness. As an alternative, a steel grillage encased in concrete may be preferable, but this will depend on the type and size of the structure.

Where other forms of failure occur in piers or abutments that are sound underneath the affected zone, the condition can generally be corrected by providing a properly-designed and constructed reinforced-concrete slab or cap.

To eliminate the occurrence of these forms of failure in new masonry bridge seats, it is my practice to provide in the design for a steel-rod mattress about two inches below the bearing surface of the bridge seat, and to provide also for sheet lead at least ¼ in. in thickness to correct any unevenness under the bearing. It must be understood, however, that both the quality of the concrete and the workmanship should be given close supervision during construction. These methods have been followed during the last 10 years on the road with which I am connected, and we have had no failures or cutting in any of the bridge seats constructed during that time.

Causes Should Be Eliminated

By General Bridge Inspector

One of two conditions will usually be found to be the cause of bridge shoes cutting into bridge seats. The first is shoes that have too small a bearing area. This condition is generally found on the older spans which were designed for lighter loadings than they are now carrying. They may have served for years without showing any tendency to cut, but start cutting suddenly when traffic increases and heavier power is placed in service. The second cause is poor concrete in the bridge seat. Both of these conditions may be aggravated by poor drainage.

In the first case the trouble can be remedied by providing shoes having sufficient bearing area to insure that the concrete will not be overstressed. The only remedy for the second case is to cut out the concrete and replace it with concrete of a better quality. In both cases, however, defective drainage conditions should be corrected.

In my experience, the insertion of steel plates is a temporary expedient which should be employed only until permanent repairs can be made. The methods of placing the smaller shoes with shoes of larger bearing area and of cutting out and replacing the concrete will depend on the size and type of the structure and the importance of the traffic. In some cases the span can be supported by blocking on the pier of abutment while the repairs are under way. In others it may be necessary to drive falsework. In either event, the work should be done as soon as the cutting of the bridge seat becomes evident to avoid damage to the span.

Burrs on Track Chisels

How should burrs be removed from the heads of track chisels? By whom should this be done? What precautions should be observed ?

Should Be Done by a Blacksmith

By N. M. GAMBLE

Supervisor, Wabash, Peru, Ind.

No burrs should ever be removed from the heads of track chisels by members of the section forces for they lack the requisite experience in heating and tempering the metal. Chisels which have burrs should always be sent to the maintenance of way shop or reclamation plant where the work can be done by an experienced blacksmith.

Within Limits, Section Forces Can Repair

By ROBERT WHITE

Section Foreman, Grand Trunk Western, Drayton Plains, Mich.

Track chisels might well be called the eye's worst enemy. If they have burred heads they should be shipped in for repair. If they are broomed only slightly, they can be ground down and reshaped if the work is done carefully. In this operation, however, there is an element of danger, and goggles should be insisted on. The grinder should be about shoulder height and should turn away from the operator. This prevents him from leaning over the wheel and directs most of the sparks away from him. No one but an expert blacksmith should be allowed to heat a chisel for an inexperienced person will either draw the temper or harden the tool until it becomes a real menace to safety. Under no circumstances should burrs ever be cut off with a cold chisel.

Should Be Done by Grinding

By A. M. CLOUGH

Supervisor of Track, New York Central, Batavia, N. Y.

To answer these questions categorically, when the head of the chisel is battered slightly but no breaks appear in the battered part, the burrs should be ground off to restore the normal section of the head. No other action is necessary. If breaks appear in the battered head they will sometimes be quite deep, reaching well into the center of the head. In such cases the head should be heated to a light white heat in a forge, cut off below the bottom of the cracks with a sharp chisel, tempered and ground to normal size. This work should be done by an experienced blacksmith who understands steel.

Among the precautions to be observed, the one of first importance in the first use of the chisel is that it

shall not be used to destruction. It should be sent to the blacksmith at the first indication of cracking or as soon as it begins to burr over. It can then be tempered so that it will be harder or softer as required. The battering of the heads of the present long type of alloy-steel chisels is aggravated by the short oval cutting edge. A flat, straight taper, very slightly curved, will cut deeper into the rail, and the effect of the blow on the head of the chisel will be less pronounced.

Cleaning Steel Bridges

What is the best method of removing dirt and scale from steel bridges that are to be painted ?

Sand Blasting Is Most Effective

By E. C. NEVILLE

Bridge and Building Master, Canadian National, Toronto, Ont.

Any one of several methods can be employed for the removal of dirt and scale from structural steel, the economy and efficiency of which will depend in some measure upon the size of the job and the condition of the steel. In general, sand blasting is conceded to be the most effective method, since this method makes it possible to clean thoroughly corners and crevices which are difficult to reach by other means. Unless the surface to be cleaned is small, it is usually the cheapest method, and it is the usual experience that a sand-blasted surface is in better condition to receive the paint.

Where air compressors are not available, the most common method of cleaning is by means of steel scrapers, hand chipping hammers and wire brushes. This method is effective and economical for small jobs, particularly where little scale or rust is encountered. The surface is inferior, however, to one that has been sand blasted, so far as the application of the paint is concerned.

Air-driven chipping hammers and rotary wire brushes are used frequently, but the surface is not as well prepared as it is with a sand blast, especially around rivet heads and in the less accessible parts of the structure. Regardless of the method employed, if heavy scale is encountered, better results will be obtained by using a heavy hammer to loosen it, as it can then be removed in large flakes, thus leaving only the thin scale and rust to be taken care of.

Of equal importance with the economy of cleaning the surface is the influence of the preparation of the surface on the life of the paint. Most of the ordinary paints, if properly applied to a smooth, well-cleaned surface, will outlast paints of better quality which have been applied carelessly to a rough or poorly cleaned surface. For this reason it is economical to spend the time and make the efforts necessary to do a first class job of cleaning.

This Old Problem Is Ever New

By L. G. BYRD

Bridge and Building Supervisor, Missouri Pacific, Wynne, Ark.

This is not a new problem, since it came into existence with the first metal bridge. It is an important one, however, when considered in the light of the total investment of the railways in steel bridges, or that of even an individual railway. It requires almost continuous thought and planning to devise economical and effective methods with a view to securing the best protection obtainable against corrosion on all parts of structures. Since this protection is so important to prevent deterioration, it follows that we should spare no effort to clean the surfaces thoroughly before repainting.

Where a large amount of dirt has accumulated on cover plates, on flanges and in the angles of braces, etc., it should be swept off with stiff brooms or washed off with water, preferably under pressure. Three methods are available for removing the remainder of the dirt and the scale at low cost: (1) Sand blasting; (2) small pneumatic chisels with a plunger type hammer, and rotary steel brushes; and (3) hand methods. My observation is that the use of the pneumatic hammers and brushes is preferable. They can be used to excellent advantage, and if the supervision is what it should be, the metal will be cleaned thoroughly. The chisels are especially valuable at the laps of steel plates and in the corners of angles; the rotary brushes are particularly adapted for use on rivet heads, while the application of both tools to other parts of the structure insures clean surfaces at moderate cost and with a marked reduction in physical effort.

Air compressors of large capacity are required where these tools are used, particularly if the structure is large, to make it possible to operate both the tools and paint sprays simultaneously. If this is done, the cleaned metal can be given a coat of paint before there is any opportunity for corrosion to start. It is my experience that tools of this type make it possible to reduce the cost of cleaning bridges by one-third as compared with purely manual methods.

Tie Plating Curves

If sufficient tie plates are available for only one rail on a curve, should they be placed under the high or the low rail? Why ?

Would Place Them Under Low Rail

By N. M. GAMBLE

Supervisor, Wabash, Peru, Ind.

If only enough tie plates are available for one rail of a curve, I prefer to place them under the low rail. Where there is a wide variation in the speed of trains, and particularly if there are many slow freight trains, the mechanical damage to the ties is greater under the low rail. For this reason, by placing the tie plates under this rail, the damage is reduced and the life of the ties conserved.

The Unplated Rail Will Spread

By J. PADGETT

Section Foreman, Missouri Pacific, Hargrave, Kan.

This question places one on the horns of a dilemma. If the tie plates are placed under the low rail on a curve, the high rail is left without protection and will tend to spread, thus affecting both gage and line. For this reason it must be watched closely. This rail does not cant outward as readily as the low rail, so that the ties are not damaged so much from rail cutting as from excessive spiking in an effort to maintain gage.

On the other hand, if the tie plates are placed under the high rail only, the low rail will cut deeply into the ties, particularly under the outer edge of the base, as a result of the marked tendency of this rail to tip outward. When it cants outward, the wear is greatest near the gage edge of the running surface of the head, and the effect of batter is aggravated throughout the curve.

Because the damage to both rails and ties is greater on the low side of the curve, I would place the tie plates

under the low rail, provided the conditions are as assumed in the question. The best results are obtained, however, when both rails of a curve are fully tie plated.

Depends on Train Speeds

By District Roadmaster

If the normal speeds of all trains are about equal, I would place the tie plates under the high rail to minimize the tendency of this rail to crowd out and thus distort both line and gage. If there is a wide variation between the speeds of passenger and freight trains, as on a heavy upgrade and on slow track, I would place the tie plates under the low rail to reduce the cutting of the ties and extend their service life.

Prefers Them Under the High Rail

By R. ROSSI

Yard Foreman, Alton, Chicago

Under the conditions assumed, the tie plates should be placed under the high rail of the curve. In the passage of high-speed trains this is the important rail, which receives the thrust of the wheel flanges and which tends most quickly to get out of line and gage. In making this recommendation, I do not ignore the desirability of having the low rail tie-plated, but when it becomes a choice between the two, I consider from every point of view that the high rail should be given preference.

Advocates Placing on Alternate Ties

By F. C. ANDERSON

Section Foreman, Chicago, Burlington & Quincy, Lynden, Ill.

Unless the curve is surfaced when the application is made, placing the tie plates under the high rail will increase the elevation, thus throwing more of the weight of the slower trains on the low rail, which will in turn aggravate the damage to both rail and ties. It will also result in a more rapid outward tipping of this rail and the consequent widening of the gage.

On the same basis, if they are placed under the low rail, the elevation will be decreased and the tendency of the high rail to spread will be aggravated. For these reasons, the best plan will be to place the plates under both rails on every alternate tie and tighten up the intermediate ties by tamping.

Offers an Alternate Suggestion

By L. G. BYRD

Bridge and Building Supervisor, Missouri Pacific, Wynne, Ark.

In a measure, the question as it stands seems to me to be somewhat impracticable, as the placing of tie plates under only one rail of a curve should always be avoided. The principal justification for the use of tie plates is that they prevent damage to the ties and thus conserve their service life. If they are applied to only one end of the ties, the other end is left unprotected, and when that end has received sufficient damage, the tie must be removed, no matter how well preserved the protected end may be.

For these reasons, if a sufficient number of the plates is not available for both rails of a curve, every alternate tie should be fully plated, and the unplated ties should be tamped to a full bearing against the rail. This method not only has the advantage of providing the maximum protection against rail cutting that is possible under the conditions, but it also affords the greatest resistance to the widening of the gage which tends to occur on curves.

While this is the best method of meeting the assumed conditions, it may be somewhat of an indirect answer. To follow the question more directly, if there are good reasons for placing the tie plates under one rail only, the decision as to which one shall be protected will be governed largely by the character of the traffic. If high-speed trains are in the majority, I would select the high rail, to avoid the spreading of this rail. On the other hand, for a preponderance of low-speed trains, the tie plates will give better protection to both rail and ties if placed under the low rail.

Would Decide on Basis of Traffic

By W. R. GARRETT

Yard Foreman, Chicago, Burlington & Quincy, Pacific Junction, Ia.

In my opinion the decision as to which rail should be tie plated should be based on the character of the traffic. On a line where slow traffic predominates, I would place the tie plates under the low rail to minimize the tendency of the rail to cant outward and cut the ties. On the other hand, if high-speed traffic predominates, the load on the low rail is less, while the outward thrust of the wheels against the high rail tends to force this rail out, making it difficult to maintain line and gage. Under these circumstances, the placing of tie plates under the high rail will increase its resistance to these thrusts, thus promoting safety and reducing the amount of labor.

Suggests the Alternate-Tie Method

By G. STAFFORD

Section Foreman, Canadian National, Rosebud, Alta.

One of the outstanding advantages of having tie plates under the high rail on curves is that they increase the resistance of the rail to the lateral thrust of the wheels of high-speed trains. Among the numerous advantages of tie-plating the low rail are the reduction in the damage to the ties from rail cutting and from the necessity of frequent adzing and respiking. Furthermore, much of the rail batter on the low rail is the result of the tendency of this rail to turn over under the pressure exerted by slow-moving trains.

In my opinion, neither of the methods suggested in the question is satisfactory. Better results will be obtained by full-plating alternate ties. In this way the number of tie failures will be reduced by half, while the damage from rail batter will be decreased. The necessity for adzing the intermediate ties periodically will be eliminated or at least minimized, while the need for constantly gaging the curve, particularly in winter, will be avoided.

Protects Ties Better If Under Low Rail

By JOHN BEDNARZ

Section Foreman, Great Northern, Rugby, N. D.

Tie plates are used primarily to protect the ties against the damage which results from rail cutting. For this reason, the decision should be based on the maximum protection which will be afforded to the ties by the installation of the tie plates. In my opinion this protection will be obtained in greater measure by placing them under the low rail.

On curves, however, other elements are introduced, these being the rate of rail batter and the tendency of the low rail to tip over under the action of slow freight trains. It is the common experience that the use of tie plates under the low rail reduces the rate of batter, while they minimize the tendency of this rail to turn over. These are added reasons, therefore, why it is preferable to place the tie plates under the low rail.

New and Improved Devices

New Buckeye Convertible Shovel

THE Buckeye Traction Ditcher Company, Findlay, Ohio, has brought out a new 7/10-cu. yd. capacity convertible shovel, known as Model OB, of which one of the most outstanding features is the spring-stop shock absorber with which it is equipped. With the ring gear free to rotate against spring pressure through a slight angle in either direction, it is claimed that the kinetic energy of the swinging shovel base is overcome with only a fraction of the strain being transmitted to the swing clutch and gear. The Model OB is convertible for use as clamshell, crane, dragline, backfiller, skimmer or backhoe.

In the Top View is Shown the New Buckeye 7/10-Yd. Convertible Shovel, While at the Left it Is Seen as a Dragline. The Bottom View Illustrates the Spring-Stop Shock Absorber

The shovel is powered with a four-cylinder, heavy tractor-type Waukesha motor, which develops 50 hp. at 1,200 r.p.m. The bore of the cylinders is 4½-in. by 6¼-in. Standard equipment includes an electric starter, a generator and a storage battery. The motor is mounted on a cast sub-base as a complete assembly with the radiator, the clutch and the transmission unit. A choice of two speeds for every operation is provided by a two-speed gear-reduction unit, while the correct drum speed is obtained through an additional two-speed selective gear shift for the hoist drum. The cable drums have a capacity of about 200 ft. of ⅝-in. cable.

Clutches of the twin-disc type, in which adjustment is made at one point on each clutch are also a feature of this shovel. The positive-type crowd mechanism of the shovel is operated by a chain drive from the fulcrum of the boom.

The alligator traction units of the shovel are controlled independently by two reversing clutches and are also provided with independent brakes. The treads have a ground pressure of less than 10 lb. per sq. in. If desired, flanged wheels may be supplied in place of the crawler treads. The machine travels and is steered with the rotating base in any position.

Electric alloy steel is used throughout the machine. Both the traveling and revolving bases consist of one-piece steel castings, and the ring gear is of cast steel with internal teeth. All spur and bevel gears are cut from electric steel blanks and are heat treated, while the principle shafts are heat-treated chrome-nickel steel.

All shafts are supported by bearings mounted on finished cast steel bases, while the drive shafts, controlling rotation, traction and the boom hoist are mounted on Timken roller bearings. All bearings are provided with Alemite pressure lubrication.

Without the boom, the height of the machine is 9 ft. 7 in. and the swinging radius from the center pin to the rear end is 8 ft. The distance from the center pin to the boom hinge is 6 ft. 6 in., the overall width is 8 ft. 2 in., the width over the alligator wheels is 8 ft. 2 in., the distance between the centers of the end shafts of the alligator traction units is 8 ft. 3 in., and the axle clearance from the ground line is 16 in.

Part-Circle Pipe From Multi-Plates

THE Armco Culvert Manufacturers Association, Middletown, Ohio, is now applying the principle of its Multi-Plate pipe to the fabrication of part-circle culverts having a semi-circular section with a flat base. As described in detail in the April issue of *Railway Engineering and Maintenance*, page 278, Multi-Plate pipe consists of corrugated curved plates that are bolted together in the field to form culverts of various diameters and lengths.

Illustrating Part-Circle Pipe From Multi-Plates

Part-circle Multi-Plate pipe is manufactured with 3, 4 and 5 arch plates which form spans ranging from 90 to 220 in. at the bottom and in multiples of five feet in length. The arch plates are available in 3, 5 or 7-gage metal. The base of the culvert consists of transverse sections 30 in. wide made of plain (uncorrugated) plates that have been formed to provide 4½-in. flanges on all

four sides. The end flanges, which are turned up, provide the means for a bolted connection to the arch, while the side flanges, which are turned down, stiffen the plates to resist the foundation pressure. A 14½-in. apron plate with a 3-in. curtain wall is provided at each end of the pipe. All plates, both flat and corrugated, are of Armco ingot iron.

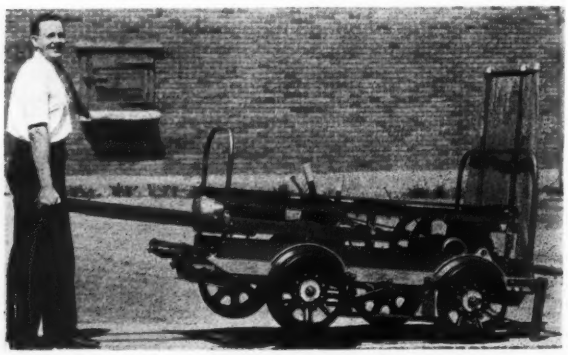
Before this development was announced, the part-circle pipe was subjected to a test that was considered more severe than any condition that would be encountered in actual service. In this test, a pipe 120-in. across the base with five-gage metal in the arch and a three-gage base was erected on nine inches of dry sand, which presented a uniform but semi-fluid foundation similar to that found in stream beds. On this pipe a load of 76,025 lb. of metal ingots was applied, through a simple timber platform contacting the arch at three points with a maximum crown deflection of 1¼ in., and no apparent tendency to failure.

New Fairmont "One-Man" Section Car

FAIRMONT Railway Motors, Inc., Fairmont, Minn., has placed on the market a section motor car, known as the M14, which has a capacity for six or seven men but which may be handled by one man. The car, which weighs 650 lb., is said to have a lifting weight of 101 lb. with the lifting handles extended. The handling of the car is also facilitated by rail skids.

Alcoa aluminum alloy, which is said to have a tensile strength equal to that of structural steel although it weighs only about one-third as much, is used in the main frame of the car. The diagonal bracing consists of Haskelite PlyMetL, while the seat frame, with front and rear safety rails, is made of steel tubing. Elsewhere throughout the car parts made of aluminum are used where practicable, there being a total of 70 such parts.

The seat of the car is 65 in. long and 26 in. wide, while the full-length tool tray on each side has an inside length of 67½ in. and a depth of 6½ in. at the front and of 3 in. at the rear. The tool tray bottoms are covered with metal. Timken bearings are utilized in the belt idler and the four axle boxes, with standard 1½-in. axles, which are said to give the car a load capacity of 1,500 lb. The wheels, which are demountable, are provided with standard 16-in. by ¼-in. pressed-steel section-car tires.



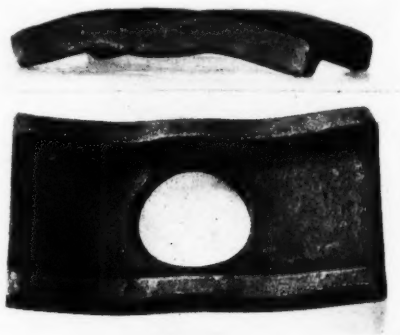
The M-14 Car Is Handled Easily by One Man

The car is powered with a five to eight-horsepower, condenser-cooled engine, which is provided with a Lynite aluminum alloy piston and connectng rod. Power transmission is by a direct belt drive and it is said that the car easily hauls a trailer and load of 4,000 lb. up a one per cent grade.

A two-speed transmission can be supplied with the car in place of the direct belt drive, where the grades are heavy or where trailers are used constantly. This transmission is equipped with Timken bearings and has two spool gears of hardened cut steel that are housed in an oil-tight aluminum case. In a test it is reported that this car hauled four trailers each carrying loads of 4,000 lb. up a 0.25 per cent grade at a speed of 12½ miles an hour, with the engine running at only 1,180 r. p. m., while cars with the direct belt drive handled three men and a 4,000 lb. load up the same grade at a speed of 25 miles an hour.

Woodings-Verona Develops New Spring Device for Track Bolts

A NEW spring device for track bolts, known as the Verona Triflex spring, has been developed by the Woodings-Verona Tool Works, Verona, Pa. As will be noted by referring to the illustration, this spring, which is a high-carbon forging having a channel section, has the form of a flat arch, but with a short reverse curve at the crown that is convex downward. This feature of the design was introduced with the object of providing a measure of the tension developed in the bolt. In other words, the spring has been so proportioned that a bolt



Verona Triflex Spring

tension of about 20,000 lb. will be attained when this convex curve is brought into contact with the surface of the angle bar. It will also be noted that the spring has at all times a four-point bearing on the angle bars, these bearings being provided at the four corners. It is claimed that this design insures an unusually high reactive spring pressure. In addition, it is also claimed for this device that it requires a minimum of wrenching to install and less wrenching to maintain, that it holds the angle bars in position to function properly and that it distributes the bolt stress uniformly through the angle bar, while it has a high reserve of spring capacity and provides a safeguard against freezing joints.

A FAST CATTLE TRAIN—The first shipment of cattle over the Missouri-Kansas-Texas lines from Fort Worth, Tex., to St. Louis, Mo., without a stop fror food or water, was handled last month. Special handling was asked for a13-car shipment of cattle for Chicago, and special handling the shipment had. The 757-mile run was made in 32 hr. and 45 min., although two additional cars were picked up at Parsons and 12 more at Sedalia, giving the train a total of 27 cars when it reached St. Louis.

News of the Month . . .

R. C. C. Authorizes Loans to Railroads

The Railroad Credit Corporation, which was formed to administer the benefits to needy carriers of the freight rate increase authorized early in the year by the Interstate Commerce Commission, reports that, as of April 30, loans to roads to enable them to meet their fixed interest obligations, authorized but not actually made, totaled $14,492,577, while the loans actually made totaled $4,188,582.

C. F. & I. Celebrates Anniversary

On April 12 the Colorado Fuel & Iron Co. celebrated the 50th anniversary of the rolling of the first steel rail ever made west of the Mississippi river. Ten years earlier the Central Colorado Improvement Company was organized, which company, through a series of mergers and consolidations, became a part of the Colorado Fuel & Iron Co. in October, 1892.

Railway Inventories Are Lower

The annual analysis by the Railway Age of railway materials on hand and used shows that on January 1, 1932, the Class I railways had $361,500,000 invested in materials and supplies, which was $69,500,000 less than on January 1, 1931, and $394,000,000 below the corresponding figure for the peak year of 1920. As a consequence, railway inventories, both in money value and volume of material, were lower on January 1 than at any time during the last 16 years.

Have Official Salaries Been Cut?

An inquiry for the purpose of ascertaining how many railroad officials paid at the rate of $10,000 a year or more in December, 1929, were still receiving that much in March, 1932, has been instituted by the Interstate Commerce Commission. The order called for a report by May 23. It was addressed to the presidents of all Class I railways and was not accompanied by any explanation as to the purpose for which this information is to be used.

Recall Maintenance Employees

Approximately 1,500 track employees of the Illinois Central were returned to service on a full-time basis on May 1, while in addition 1,000 part-time employees were placed on full-time schedules. During May, the company expected to double its April expenditures for track maintenance, which amounted to about $550,000. The Chicago, Milwaukee, St. Paul & Pacific has added more than 1,600 men to its track gangs, while the Missouri Pacific added 750 employees to its shop forces at Little Rock, Ark., and Sedalia, Mo.

Oil Pipe Lines Total 111,660 Miles

Pipe lines used for transporting oil in the United States have an aggregate length of 111,660 miles according to a survey completed recently by G. R. Hopkins, economic analyst in the petroleum economics division, United States Bureau of Mines. Of the total mileage, 58,020, or 52 per cent, are trunk lines and 53,640 miles, or 48 per cent, are gathering lines. During the last five years, pipe-line mileage has increased 24 per cent.

Pullman-Railroad Excursions

Numerous excursions, wherein both railroad and Pullman fares will be reduced, will be operated during the summer months, beginning May 15, by the railroads and the Pullman Company in an effort to encourage and stimulate summer train travel. Low-rate round-trip tickets will be sold from New York, Philadelphia, Baltimore, Washington, Boston, Montreal and a number of other eastern cities to the Pacific coast, to national parks in this country and Canada, and to other points of interest in the west.

"Compartment" Cars for Freight

On May 6, the Chicago & North Western instituted a new type of service for l.c.l. freight between Chicago and Waukegan, Ill., Kenosha, Wis., Racine and Milwaukee. Automobile box cars have been fitted with interior partitions to provide four freight compartments, two in each end, and the charges for the transportation of freight in these compartments are based not on weight, but on a flat rate of $15 per compartment. The North Western has reconstructed 10 cars for this service and more will be added if it proves to be valuable.

Net of Barge Lines Shows Increase

The annual report to the Secretary of War of the Inland Waterways Corporation, the government-owned barge line operating on the Mississippi river and its tributaries, shows a "net operating income" of $298,756 for 1931, as compared with $65,177 for 1930. This figure, however, is misleading to the extent that the waterways corporation, unlike the railways, is not required to include in its expenses charges for maintaining the rivers for navigation and flood control. This policy was defended in the report of Major General T. Q. Ashburn, chairman of the corporation, who said that the cost of this work "would be the same whether the corporation operated or not. Consequently these costs are not a proper charge against the Inland Waterways Corporation."

Garden Plots for Employees

Desiring to do everything within its power to aid its employees to lower the cost of living, the Pennsylvania is making available suitable tracts of vacant land owned by the company for their use, whether active or furloughed, for vegetable gardens. The company has requested that every employee who otherwise would be unable to have a garden, apply for one of the plots.

New Body to Oppose Barge Lines

Growing opposition to government in business is evidenced by the organization at Centralia, Ill., of the Inland Transportation Protective Association for the purpose of demanding that the United States government discontinue the operation of barge lines on the inland waterways in competition with private enterprise. This is the second organization of citizens formed recently in Illinois to oppose government barge operations on the rivers, the first organization being the National Inland Shippers' Association, which was organized in December in Springfield, Decatur and Bloomington.

Begin Hearings on Six-Hour Day

At the opening hearing on May 11 before the Interstate Commerce Commission under the Congressional resolution directing the commission to investigate the effect upon operation, service and expenses of the application of the six-hour day in railway service, railway spokesmen disclosed that the payrolls of Class I railroads would be increased 25 per cent by such a measure. It was estimated that for the year 1930, this increase would have amounted to more than $600,000,000, if employees had been paid for six hours work what they are now getting for eight hours. Such an increase as this, it was said, would have resulted in the failure of the roads to meet fixed obligations by about $100,000,000.

Safety Council Makes Awards

Winners in the eight groups of the annual steam railway accident prevention contest for 1931 conducted by the National Safety Council, in which Class I railways in the United States competed, were awarded trophies at a dinner held at the Stevens hotel, Chicago, on May 17. In Group A the Union Pacific System was awarded first place, with a rate of 1.86 casualties per million man-hours, while first place in Group B was won by the Union Pacific Railroad with a casualty rate of 1.66. In this group a lower casualty rate, 1.59, was attained by the Chicago & North Western, but because that road won first place last year, it could not compete for that position last year. Similarly, in group B the Union

Pacific Railroad was given first place because the Atlantic Coast Line, with a casualty rate of 1.10 could not win two years in succession. Winners of other groups and their casualty rates are as follows: Group C, the Oregon-Washington Railroad & Navigation Co., 1.69; Group D, the Los Angeles & Salt Lake, 1.88; Group E, the Gulf, Mobile & Northern, 1.27; Group F, the Ann Arbor, 0.96; and Group G, the Green Bay & Western, 0.77. In the Switching and Terminal division, the following were the winners: Group A, the Union Railroad, 1.89; and Group B, the Conemaugh & Black Lick, 1.68.

Loss and Damage Payments

The average loss and damage payment per car of fresh fruits, melons and vegetables made by the railroads on 990,557 cars moved in 1931 was $9.20. Tomatoes showed the largest payment, an average of $36.08 per car, while white potatoes were the lowest, $1.34.

T. & P. Forbidden to Drill on Right of Way

In a recent opinion of the state court of civil appeals of Texas the Texas & Pacific was forbidden to drill for oil or gas on its right of way through the oil fields of West Texas, on the ground that this property represents only an easement from the state. The railroad sought to obtain permits to drill in the Ector County oil field but the Railroad Commission of Texas refused to grant permission and the case was carried to the courts.

Says I. C. C. Cannot Enforce the Ten Commandments

In reply to the request of John W. Cooper of Nashville, Tenn., to the Interstate Commerce Commission that the railroads be required to stop operating trains on Sundays, the Pennsylvania has filed an answer stating that the Interstate Commerce Act "confers no authority on the Interstate Commerce Commission to enforce the Ten Commandments or any one of them" and that if the act were to be construed as conferring such authority it "would be beyond the constitutional powers of congress and therefore invalid."

Women's Aid on the Pennsylvania

In 1931, the Women's Aid of the Pennsylvania, which is composed of mothers, wives, daughters and sisters of employees of that road, spent more than $275,000 in relieving distress among employees of this road, which is about 60 per cent greater than the amount disbursed in the preceding year. During the year, members of the group made visits totaling 42,532 to families needing assistance or suffering from sickness. This organization, of which Mrs. W. W. Atterbury, wife of the president of the road, is director-general, was organized during the World War, when many employees had entered the army and navy.

Association News

Metropolitan Track Supervisors' Club

The annual meeting of the Metropolitan Track Supervisors' Club, at which the election of officers will take place, will be held on Saturday, June 11, at Keen's Chop House, 72 West Thirty-sixth street, New York City. Following a special dinner, which will be served at 6 p. m., and the transaction of the official business of the club, the meeting will take the form of a smoker.

American Railway Engineering Association

Eight committees held meetings during May. The Committee on Water Service and Sanitation met at Memphis, Tenn., on May 3 and 4, in connection with the convention of the American Water Works Association. The other committee meetings were: Iron and Steel Structures, at Pittsburgh, Pa., on May 5 and 6; Masonry, at New York on May 12 and 13; Economics of Railway Operation, at Chicago on May 12; Track, at Chicago on May 17; Standardization, at New York on May 20; Shops and Locomotive Terminals, at Chicago on May 23; and Records and Accounts, at Cleveland, Ohio, on May 24. The Board of Direction met at Chicago on May 17.

So far only one committee, that on Economics of Railway Labor, has a meeting scheduled for June. This will be held at Chicago on June 10.

Wood Preservers Association

Arrangements are being completed for the joint meeting of committees of the association with the Committee on Wood Preservation of the A. R. E. A. at the Shoreham hotel, Washington, D. C., on June 21-22. In addition to the A. R. E. A. committee, the Executive Committee of the A. W. P. A. and the committees on Pressure Treatment of Poles, Marine Piling, Service Records, Treatment of Car Lumber and Diversified Uses of Treated Wood have already called meetings at that time. It is expected that several of the other committees will arrange for meetings at the same time in order to further the work of their respective groups. An informal dinner is planned for Tuesday evening, at which there will be present officers of several government bureaus engaged in the investigation of timber and its uses. On Wednesday forenoon a trip of inspection is planned to the United States Bureau of Standards.

Employment Increases in March

The number of employees in the service of Class I railways as of the middle of March was 1,096,541, an increase of 3,326 as compared with the number in February, according to the Interstate Commerce Commission.

Personal Mention

General

George H. Warfel, assistant to the general manager of the Union Pacific Railroad, with supervision over safety matters, and formerly a general roadmaster on this road, has been promoted to assistant to the vice-president in charge of operation of the Union Pacific System, in which position he will have charge of safety matters over the entire system. Mr. Warfel, whose headquarters will remain at Omaha, Neb., began service with the Union Pacific on August 1, 1901, in the maintenance of way department, and was promoted through various positions to that of general roadmaster, which position he was holding on January 1, 1927, when he was further advanced to assistant to the general manager.

Charles H. Ewing, vice-president of the Reading, and formerly engineer maintenance of way of its predecessor company, the Philadelphia & Reading, has been elected president, to succeed **Agnew T. Dice,** whose death was mentioned in the May issue. Mr. Ewing was born on May 28, 1866, at Pottstown, Pa., and was educated in civil engineering by private tutoring. He first entered railway service in August, 1883, as a rodman on the

Charles H. Ewing

Philadelphia & Reading, subsequently serving with this road as assistant engineer and supervisor. In 1892, he went with the Central New England (now part of the New York, New Haven & Hartford) as a division engineer, later being advanced to chief engineer. After 10 years with the Central New England, Mr. Ewing returned to the Philadelphia & Reading as a division engineer, which position he held until 1905, when he was promoted to engineer maintenance of way. Five years later he was transferred to the operating department as superintendent of the Atlantic City Railroad (part of the P. & R.). Subsequently, Mr. Ewing was advanced through the positions of general superintendent, general manager and vice-president of the Phila-

delphia & Reading. During the war he acted as federal manager of the Philadelphia & Reading, the Central of New Jersey and the Staten Island Rapid Transit. At the close of federal control in 1920, he resumed the position of vice-president of the Philadelphia & Reading, which position he continued to hold when this road become known as the Reading in 1924. Mr. Ewing's headquarters are at Philadelphia, Pa.

Thomas B. Hamilton, vice-president of the Western region of the Pennsylvania, with headquarters at Chicago, and formerly an engineer maintenance of way on this road, retired on May 2, after having served the Pennsylvania for more than 43 years. Mr. Hamilton, who is 66 years of age, was born at Columbus, Ohio, and was educated at Princeton University.

Thomas B. Hamilton

He entered the railway service with the Pennsylvania in 1888, as a rodman on the engineering corps. In 1896, he was promoted to assistant engineer, being further advanced to engineer maintenance of way in 1897. After serving in the latter position at various points, Mr. Hamilton was transferred to the operating department as a division superintendent in 1901. Thereafter he served successively as general superintendent of the Central system, general manager of the Vandalia (now part of the Pennsylvania), resident vice-president of the Lines West of Pittsburgh, general superintendent of the St. Louis system, general manager of the Northwestern region, regional vice-president and general manager of the same region and vice-president and general manager of the Western region, being elected vice-president of the latter region in 1926, with headquarters at Chicago.

Engineering

R. B. Hennessy, bridge engineer, and **R. C. Stephens,** architect, of the St. Louis-San Francisco, have moved their headquarters from St. Louis, Mo., to Springfield.

E. M. M. Hill, reconnaissance engineer of the Western region of the Canadian National, has been promoted to engineer of construction, with headquarters as before at Winnipeg, Man., to succeed **William Burns,** who has retired after more than 33 years of service with this road.

R. R. Nace, chief engineer maintenance of way of the New York zone of the Pennsylvania, with headquarters at New York, has been appointed to the newly-created position of engineer, maintenance of way, with the same headquarters, and the position of chief engineer maintenance of way has been abolished.

R. P. Cummins, office engineer of the St. Louis-San Francisco, at St. Louis, Mo., has been appointed division engineer of the Northern division, with headquarters at Ft. Scott, Kan., to succeed **J. O. Armstrong,** who has resigned. The position of office engineer has been abolished.

Gustave A. Laubenfels, district engineer of the old Iowa district of the Chicago, Burlington & Quincy until its consolidation with the former Missouri district to form the Central district about a year ago, with headquarters at Burlington, Iowa, retired from active service on May 1.

H. S. Marshall, valuation engineer of the Chicago, Burlington & Quincy, with headquarters at Chicago, has resigned and the position of valuation engineer has been abolished. Henceforth valuation matters will be under the jurisdiction of **A. W. Newton,** chief engineer, at Chicago.

C. B. Clegg, supervisor of water service of the Western Lines of the Atchison, Topeka & Santa Fe, with headquarters at Amarillo, Tex., has been placed in charge of heating matters on these lines in addition to his present duties, with the title of water service and heating engineer. **D. M. Bisbee,** heating engineer, at Amarillo, will retire on June 1 and the position of heating engineer will be abolished.

E. E. Moberly, division engineer on the Union Pacific, with headquarters at Marysville, Kan., has been transferred to the Utah division of the Oregon Short Line, with headquarters at Pocatello, Idaho, succeeding **M. H. Brown, Jr.,** who has been transferred to the Idaho division, with the same headquarters. Mr. Brown succeeds **L. W. Althof,** who has been assigned to other duties. Both roads are units of the Union Pacific System.

Allan W. Carpenter, assistant valuation engineer of the New York Central Lines, with headquarters at New York, has been appointed bridge engineer in the maintenance of way department of the New York Central Railroad, with headquarters as before at New York, succeeding **James L. Miller,** who died on April 29. The position of assistant valuation engineer, New York Central Lines, has been abolished. Mr. Carpenter was born at Port Henry, N. Y., on February 28, 1873, and received his higher education at Case School of Applied Science, Cleveland, Ohio, from which he graduated in 1895. He entered railway service on March 1, 1900, with the New York Central & Hudson River as an assistant engineer in the bridge department, and has since been in continuous service with that road and its corporate successor, the New York Central. In 1902, he was appointed supervisor of bridges and buildings on the Pennsylvania division, and in 1903, he was advanced to division engineer of the same division. In 1904, he became engineer of bridges in the maintenance of way department, which position he held until 1906, when he was appointed engineer of structures in the engineering department. From 1913 to 1924, he served as assistant valuation engineer of the New York Central, and in 1925, he was appointed to a similar position on the New York Central Lines, which position he was holding at the time of his appointment as engineer of bridges.

W. A. Spell, who has been appointed chief engineer of the Atlanta, Birmingham & Coast, with headquarters at Atlanta, Ga., as noted in the May issue, was born on November 21, 1882, at Aurora, Tex. Mr. Spell entered railroad service in 1901, with the St. Louis-San Francisco. From 1902 to 1903 he was employed on the construction of the White Mountain division of the Iron Mountain Southern (now part of the Missouri Pacific). In 1903, he entered the service of the Pittsburgh & Lake Erie as a rodman, which position he held until 1904, when he became assistant resident engineer on location and construction of the Illinois, Iowa & Minnesota (now part of the Chicago, Milwaukee, St. Paul & Pacific). From 1905 to 1906, Mr. Spell served as a transitman on location, and office engineer in the division engineer's office at Kinder, La., on the construction of the Gulf Coast Lines (a unit of the Missouri Pacific). In 1906, he entered the service of the Atlanta, Birmingham & Coast (at that time the Atlanta, Birmingham & Atlantic) as a draftsman, and in 1913 was advanced to principal assistant engineer, serving in that capacity until 1925. From 1917 to 1918, he also held a similar position with the Georgia Railroad, the Atlanta & West Point, and the Charleston & Western Carolina. In 1925 he was advanced to engineer maintenance of way of the Atlanta, Birmingham & Coast, the position he held until his recent promotion.

Coincident with the consolidation of the Ohio and St. Louis divisions and the Indianapolis and Toledo divisions of the Baltimore & Ohio, to be known as the St. Louis and Toledo divisions, respectively, a number of appointments have been made among division engineering officers. The original divisions comprising the enlarged divisions will retain their identities as the Ohio and St. Louis subdivisions of the St. Louis division, and the Indianapolis and Toledo subdivisions of the Toledo division. **C. E. Herth** and **R. W. Gilmore,** division engineer and assistant division engineer, respectively, of the Ohio division, with headquarters at Chillicothe, Ohio, have been appointed to the same positions on the Ohio subdivision of the St. Louis division, with headquarters at Cincinnati, Ohio. **R. W. Gabriel** and **E. R. McKee,** division engineer and assistant division

engineer of the original St. Louis division, with headquarters at Washington, Ind., have been transferred to the St. Louis subdivision of the St. Louis division, with headquarters also at Cincinnati. **R. E. Chamberlain,** division engineer of the original Toledo division, now has jurisdiction over the combined Toledo and Indianapolis divisions, with headquarters as before at Dayton, Ohio. **H. F. Passel,** division engineer of the Indianapolis division, has been appointed assistant division engineer on the Toledo division, with headquarters as before at Indianapolis, Ind. **W. E. Graham** remains as assistant division engineer on the Toledo division at Dayton.

Track

D. G. Beatty, roadmaster on the Saskatoon division of the Canadian Pacific, with headquarters at Saskatoon, Sask., has been transferred to the Brandon division, with headquarters at Broadview, Sask., to succeed **A. Rois,** who in turn has been transferred to Saskatoon. **T. W. Creighton,** roadmaster on the Brandon division, with headquarters at Virden, Man., has been transferred to Brandon, Man., on the same division, succeeding **T. M. Fraser,** who in turn succeeds Mr. Creighton at Virden.

Bridge and Building

H. C. Swartz, superintendent of bridges and buildings on the Central region of the Canadian National, with headquarters at Montreal, Que., has retired.

Frank O. Draper, superintendent of bridges of the Illinois Central, retired on May 1, after having been in railway service almost continuously for 56 years. Mr. Draper, who is 70 years of age, was born

Frank O. Draper

at Brighton, Iowa, and commenced his railway career with the Chicago, Rock Island & Pacific at the age of 14. He was with this road and the Iowa Central (now the Minneapolis & St. Louis) until 1895, when he became connected with the Illinois Central as a bridgeman. Within a year, Mr. Draper was advanced to bridge foreman of the Springfield division and on February 1, 1903, he was further promoted to supervisor of bridges and buildings of the old Freeport division. He had been superintendent of bridges, with headquarters at Chicago, since October 1, 1905.

H. C. Jones, bridge and building inspector on the Portland division of the Southern Pacific, has been promoted to supervisor of bridges and buildings of the same division, with headquarters at Portland, Ore., to succeed **Norman Rose,** whose retirement was noted in the April issue.

C. A. J. Richards, assistant engineer in the office of the chief engineer maintenance of way of the Western region of the Pennsylvania, with headquarters at Chicago, has been appointed master carpenter of the Chicago Terminal division, succeeding **D. E. Sauer,** who has been appointed to the newly-created position of assistant master carpenter at Ft. Wayne, Ind.

Obituary

William J. Smith, architect for the Gulf, Colorado & Santa Fe, with headquarters at Galveston, Tex., died at that point on May 13 after a long illness.

T. T. Spreyer, who retired a year ago as general foreman of tinning and plumbing of the New York, New Haven & Hartford, died suddenly at his home at West Haven, Conn., on May 17.

James L. Miller, engineer of bridges of the New York Central, with headquarters at New York, died at his home in Yonkers, N. Y., on April 29. Mr. Miller was born at New York on July 18, 1874. He received his higher education at Columbia University and entered railway service in March, 1903, with the New York Central as a draftsman in the maintenance of way department. In January, 1906, he was appointed assistant engineer in the engineering department, and retained that position until August, 1911, when he came back to the maintenance of way department as engineer of bridges, the position he was holding at the time of his death.

W. B. Throop, formerly a division engineer and a roadmaster on the Chicago, Burlington & Quincy, who retired from railroad service in 1922, died at Galesburg, Ill., on April 29, at the age of 83 years. Mr. Throop entered the service of the Burlington in 1878 as a chainman in the engineering department and after being advanced through the positions of division engineer, roadmaster, division superintendent and general superintendent was appointed to the latter position on the Quincy, Omaha & Kansas City (a subsidiary of the Burlington) in September, 1910. On August, 1918, Mr. Throop was assigned to the staff of the operating vice-president of the Burlington, where he remained until his retirement on April 1, 1922.

Preformed Wire Rope.—The Hazard Wire Rope Company, Wilkes-Barre, Pa., has issued a 16-page booklet which discusses twelve advantageous aspects of this company's Lay-Set preformed wire rope.

Supply Trade News

General

The American Steel & Wire Company has opened a warehouse at 2364 South Ashland avenue, Chicago, to supplant its former local warehouse at 403 West Lake street.

The Caterpillar Tractor Company, Peoria, Ill., has recently added 24 dealers to its sales organization at the following points: Brandon, Man.; Harrisburg, Pa.; San Antonio, Tex.; Syracuse, N. Y.; Milwaukee, Wis., and Madison; Saskatoon, Sask.; Toronto, Ont., and Ottawa; Harlingen, Tex.; Enid, Okla.; Des Moines, Iowa; Augusta, Ga.; Fredericton, N. B.; Grand Forks, N. D.; Shamokin, Pa.; Irvington, N. J.; Omaha, Neb.; Council Bluffs, Iowa; Cincinnati, Ohio; Plainview, Tex.; Nuevo Laredo, Tamps., Mex.; Billings, Mont., Sidney and Miles City; Quincy, Ill.; and Cleveland, Ohio.

George P. Nichols & Brother, Chicago, have acquired all the physical assets, equipment, patents and good will of the Stearns-Stafford Roller Bearing Company, Lawton, Mich., and will carry on the manufacture and sale of that company's products through the **Stearns-Stafford Roller Bearing Division of George P. Nichols & Bro., Inc.** The Nichols organization was started in 1894, as a partnership by George P. Nichols and Samuel F. Nichols, which continued until 1928, when George P. Nichols retired on account of ill health. Since 1900 the organization has manufactured transfer tables and electric turntable tractors. The Stafford Roller Bearing Car Truck Corporation, which later became the Stearns-Stafford Roller Bearing Company, was organized in 1920 and was one of the pioneers in the application of roller bearings to railroad rolling stock, and a pioneer in the application of roller bearings to scale test cars and to turntable trucks in the conversion to three-point suspension. A new corporation, George P. Nichols & Bro., Inc., supplants the former partnership and proposes to cover the field of bearings for rolling stock and turntables and equipment in heavy industrial service. It has acquired the patent rights on a split axle, equipped completely with roller bearings designed to save power and reduce the wear on wheels and track. The general office and factory will remain at 2139 Fulton street, Chicago. The manufacture of roller bearings will be carried on for the present at Lawton, Mich.

Personal

A. Clark Moore, executive vice-president of the **Positive Rail Anchor Company,** Chicago, has been elected president, succeeding **Edward B. Leigh,** who died on May 17, at his ranch in Center Point, Kerr county, Tex.

Following the formation, in October, 1930, of the **Wood Preserving Corporation,** Pittsburgh, Pa., to consolidate and co-ordinate the 22 timber treating plants of the **Ayer & Lord Tie Company,** Chicago, the **National Lumber & Creosoting Co.,** Texarkana, Tex., and the **Century Wood Preserving Company,** Pittsburgh, the following changes in organization have now been made effective. For the Wood Preserving Corporation, the following officers have been elected: President, **Grant B. Shipley,** president of the Century Wood Preserving Company; executive vice-president, **A. W. Armstrong,** president and general manager of the Ayer & Lord Tie Company; vice-president and treasurer, **S. T. Brown,** vice-president and treasurer of all Kopper's allied companies; secretary, **D. M. Gilmore,** secretary of many of the Kopper's allied companies—all with principal offices at Pittsburgh, Pa.

For the National Lumber & Creosoting Co., with administration offices at Pittsburgh: President, **Mr. Shipley,** who succeeds **Joshua S. Logan,** who retains a consulting capacity; executive vice-president, **Mr. Armstrong;** vice-president and treasurer, **Mr. Brown;** and with operating and sales offices at Texarkana, Ark.-Tex., vice-president, **E. J. Irving,** re-elected. **William M. Logan,** vice-president and assistant secretary, and **George E. Rex,** vice-president, have resigned, while **A. E. Ferguson** remains in a special capacity.

For the Century Wood Preserving Company, with offices in Pittsburgh: President, **Mr. Shipley,** executive vice-president, **Mr. Armstrong;** vice-president, **E. S. Park,** vice-president of the New England Wood Preserving Company; **H. R. Condon,** vice-president and general manager of the Delaware Wood Preserving Company; **J. S. Stockdale,** vice-president of the Century Wood Preserving Company; and **R. M. Killey,** manager of the Michigan Wood Preserving Company. Incident to these changes, the New England, Delaware, Maryland and Michigan wood preserving companies, subsidiaries of the Century Wood Preserving Company, have been consolidated with that company. The Carolina Wood Preserving Company, Charleston, S. C., also a subsidiary of the Century Wood Preserving Company, remains a separate corporation, with Mr. Shipley as president, Mr. Armstrong as executive vice-president and Mr. Condon as vice-president.

Grant B. Shipley

The organization of the Ayer & Lord Tie Company remains unchanged with headquarters and organization at Chicago, with Mr. Armstrong as president and general manager and D. C. Jones as vice-president.

Mr. Shipley was born at Coulterville, Cal., on April 27, 1880. From 1898 to 1901 he was a machinist apprentice in a general repair shop and from the latter date until 1905 he was employed as a draftsman, machine designer and chief draftsman on marine equipment, mining machinery and gold and silver machinery and plants. During three years of this period he was also an instructor of marine design and mechanical drawing at the Humboldt Evening Polytechnical School at San Francisco. In 1905 he entered the employ of the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., and during the next six years was chief draftsman and later chief engineer in charge of drawing, designing and constructing mining and timber preserving plants. From 1911 to 1932 he has been associated as an executive and operating officer with various tie, coal and timber treating companies and has been a practicing, designing and consulting engineer for timber treating and other plants. After leaving the employ of Allis-Chalmers, he organized the Pittsburgh Wood Preserving Company, occupying the position of president. In 1922 he became associated with the American Nickel Corporation, which later became the American Mond Nickel Company with Mr. Shipley as president. When the American Mond Nickel Company was taken over by the International Nickel Company of Canada in 1929, he was elected a director and a member of the executive committee of the latter company. In 1923 he organized the Century Wood Preserving Company, of which he continues to be president.

A. W. Armstrong

Mr. Armstrong was born in Evanston, Ill., on April 9, 1885, and graduated from Northwestern University in 1907. In 1903 he worked in the freight department of the Chicago & North Western, and in 1904 he entered the employ of the Ayer & Lord Tie Company in the general offices. In 1905 he returned to school; upon graduation in 1907 he was appointed superintendent of the Ayer & Lord treating plant at Grenada, Miss., and until 1915 occupied various positions in the operating department of this company. In the latter year, he was appointed secretary and treasurer, which position he held until 1925, when he was appointed general manager. In 1927 he was elected president and general manager, which positions he continues to hold. He has been active in association work, at present being chairman of the Special Committee on the Processing of Wood of the American Wood Preservers' Association.

J. Frederic Byers, vice-president of **A. M. Byers Company,** Pittsburgh, Pa., who has been elected chairman of the board, succeeding his brother, the late **Eben M. Byers,** whose death on March 31 was noted in the May issue, is a son of the founder of the company. J. Frederic Byers was graduated from Yale University in 1904 and since that time has been continuously identified with the company, serving since 1905 as vice-president. He is also a director of the Westinghouse Air Brake Company, the Union Switch & Signal Company and a number of banking organizations of Pittsburgh.

J. Frederic Byers

Trade Publications

Arc Welders.—Schramm, Inc., West Chester, Pa., has issued an eight-page bulletin, No. 3225, which illustrates and describes its entire line of engine-driven arc welders for general use, and also its railroad type, self-propelled, variable-voltage welder, adapted especially for track work and the repair or strengthening of bridges.

Flow of Water—This is the title of a new Armco engineering bulletin, issued by the American Rolling Mill Company, Middletown, Ohio, which contains information and mathematical data regarding the flow of water in Armco spiral-welded pipe. Tables giving the loss of head per 1,000 ft. of spiral-welded pipe ranging from 6 to 30 in. in diameter for various discharges, are a feature of the bulletin.

ALPHABETICAL INDEX TO ADVERTISERS

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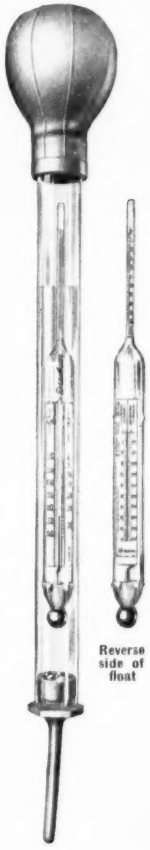

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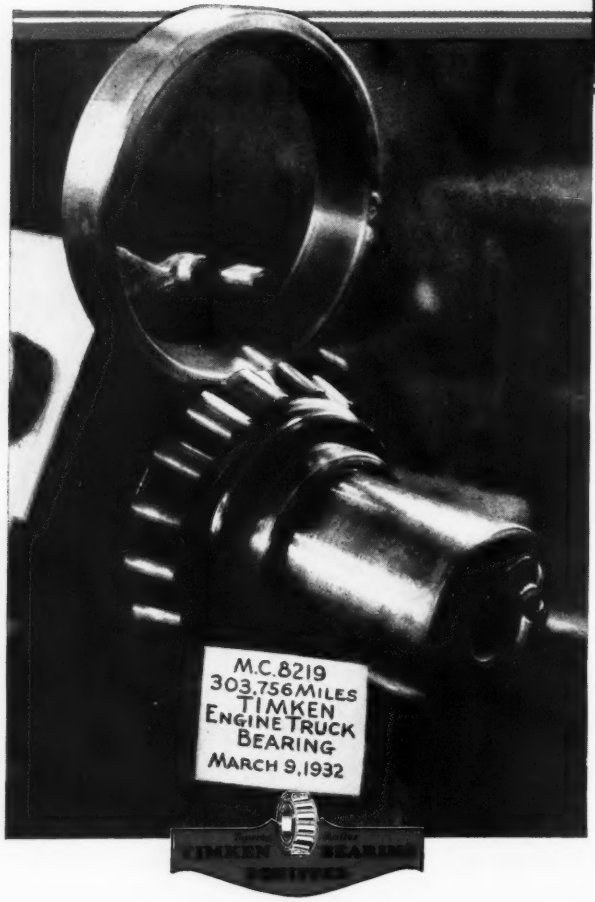

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